FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 1 - INTRODUCTION

Prepared for: EMPower

EMPower

Date: November 2021

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1. INTRODUCTION

Fehily Timoney & Company (FT) has prepared this environmental impact assessment report (EIAR) on behalf of Annagh Wind Farm Limited, a subsidiary of EMP Energy Limited (EMPower). Annagh Wind Farm Limited intends to apply to Cork County Council for planning permission to construct the proposed Annagh Wind Farm, near Charleville, County Cork. The location of the proposed Annagh Wind Farm development is shown on Figure 1-1. A full description of the proposed project is included in Chapter 3 of this EIAR.

The proposed Annagh Wind Farm turbines are located in an agricultural area in north County Cork, approximately 6km south west of Charleville and approximately 3km north of the village of Churchtown. The proposed Annagh Wind Farm development as indicated in Figure 1-1 includes lands contained within the following townlands: Annagh North, Fiddane, Cooliney, Coolcaum

The underground grid connection route (GCR) connecting the wind farm to the national grid at the Charleville Substation traverses the following townlands: Annagh North, Cooliney, Coolcaum, Rathnacally, Farranshonikeen, Ardnageehy and Clashganniv. The GCR is illustrated in Figure 3-4 of Chapter 3.

The turbine delivery route (TDR) passes through the following townlands before it enters the national primary road network at the N20: Cooliney, Rathnacally, Farranshonikeen, Ardnageehy, Clashganniv, Ballyhay. The TDR and locations of associated accommodation works required for the delivery of turbine components is illustrated in Figure 3-5 of Chapter 3 and further detailed in Chapter 13.

Replanting lands have been identified in the townlands of Emlagh, near Moyasta, County Clare. The replant lands have been assessed for cumulative impact throughout the EIAR. The location of the replant lands is illustrated in Figure 3-6 of Chapter 3.

The turbine delivery route is considered as part of the project's assessment in this EIAR but does not form part of this application for consent. Equally, an assessment has been carried out for replant lands at Emlagh, County Clare, but does not form part of the application for consent.

All elements described above form part of the project and are assessed in this EIAR.

1.1 Applicant

The application for the proposed Annagh Wind Farm is being made by Annagh Wind Farm Limited, a subsidiary of EMP Energy Limited (EMPower). EMPower is an Irish based international wind and solar energy developer with over 700 MW in development in Europe and Africa. EMPower's senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents. EMPower's vision is to provide low carbon, ecologically non-invasive, affordable energy to facilitate Ireland's expanding economy and sustainable energy targets.

1.2 Outline of the Proposed Project

The proposed project consists of four main elements:

- Annagh Wind Farm;
- Turbine delivery route (TDR);
- Grid connection route (GCR).

The proposed Annagh Wind Farm will consist of up to 6 no. wind turbine generators (WTGs), 1 no. meteorological mast, construction of new site tracks, the upgrade of existing agricultural tracks and 1 no. substation compound along with ancillary civil and electrical infrastructure.

The total Maximum Export Capacity (MEC) of the proposed Annagh Wind Farm project is approximately 37.2MW. The exact MEC will be dependent on the output power of the turbine model available at procurement stage which is subject to technological advancements. The candidate turbine model is the Vestas V150. The proposed turbines will have the following specifications:

- Three bladed, horizontal axis type turbine;
- Height of 175m from the top of the foundation to blade tip height;
- Rotor diameter of 150m;
- Hub height of 100m.

The associated grid connection cable which will connect the on-site substation to the existing Charleville Substation within the townland of Rathnacally, County Cork will consist of 38kV cables and will be approx. 5.7km in length including 3.4km to be constructed primarily within the existing road corridor with 2.3km of underground cable to be laid within private lands within the proposed wind farm site.

Large components associated with the proposed Annagh Wind Farm construction will be transported to the wind farm site via the identified turbine delivery route (TDR), as indicated in Figure 3-5. It is proposed that turbine deliveries shall approach the site from the North via Foynes Port, the N69, the N18, the M20, the N20 and L1322. Temporary accommodating works will be required at selected locations along the TDR to facilitate the delivery of large components to the site, as detailed in Section 3.5.6.

Replant lands have been identified at Emlagh, County Clare. These lands will be planted in lieu of the proposed tree felling required to accommodate the project. Tree felling and planting will be subject to a felling licence.

The construction of the project in its entirety is expected to take between 12 – 18 months.

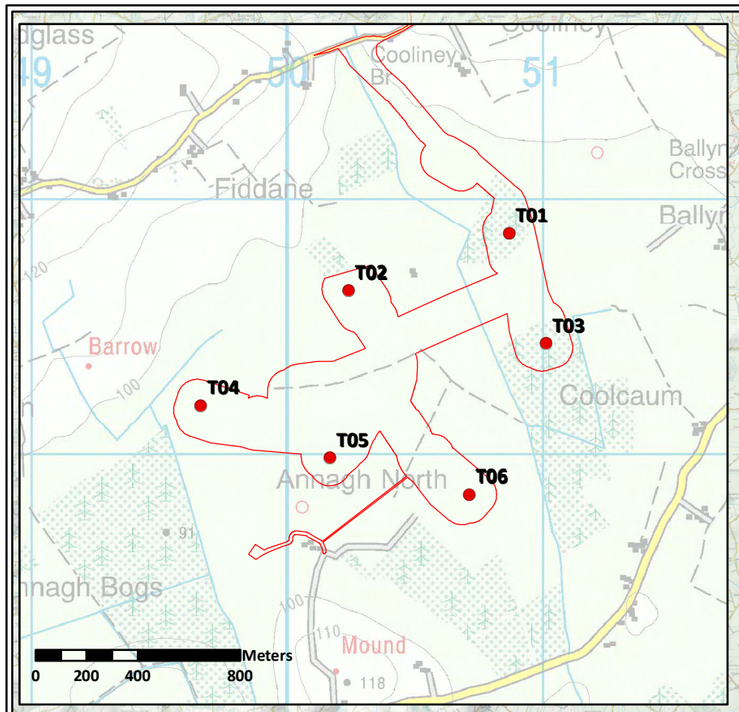
All elements of the project as described above are assessed in this EIAR, however, the proposed temporary accommodation works along the turbine delivery route do not form part of this application for consent. Equally an assessment has been carried out for replant lands at Emlagh, County Clare and is also not included in the application for consent. The replant lands are assessed cumulatively in each chapter of the EIAR and an AA Screening and NIS for the replant lands are included in Appendix 3.3 of Volume 3 of this EIAR.

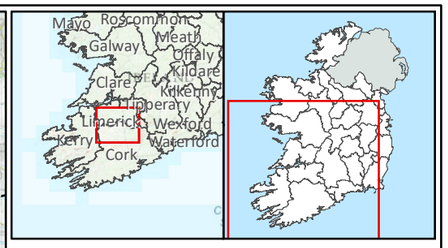
A detailed description of the proposed Annagh Wind Farm development is included in Chapter 3: Description of the Proposed Development.

The proposed Annagh Wind Farm development description as per the statutory newspaper notice and the application form for which consent from Cork County Council is being sought is as follows:

- Construction of 6 no. wind turbines with a blade tip height of 175m, rotor diameter of 150m and a hub height of 100m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure where necessary;
- Upgrade of entrance onto Local Road L1322;
- All associated drainage and sediment control including the installation of new watercourse or drain crossings and the re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. permanent onsite 38kV electrical substation to ESBN specifications including:
    - Control building with welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting;
    - Security fencing;
    - All associated infrastructure, services and site works.
- 1 no. temporary construction site compound and associated ancillary infrastructure including parking;
- Tree felling to facilitate construction and operation of the proposed development;
- Installation of medium voltage (20/33kV) and communication underground cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast with a height of 100m above ground level and associated access track;
- Installation of medium voltage (up to 38kV) underground cabling between the proposed on-site substation and the existing Charleville substation and associated ancillary works. The proposed grid connection cable works will include 2 no. watercourse crossings and the installation of 8 no. pre-cast joint bays;
- All associated site development works;
- A 10 year planning permission and 35 year operational life from the date of commissioning of the entire wind farm.

Path: R:\Map Production\2020\P2359\Workspace\CEMP\P2359_GIS_Fig1-1_SiteLocation_A3.mxd





Legend

- County Boundaries
- Proposed Site Boundary
- Proposed Turbine Layout

0 2.5 5 10 Kilometers

TITLE: Site Location			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	1.1		
CLIENT:	EMPower		
SCALE:	1:200000	**REVISION:**	0
DATE:	14/10/2021	**PAGE SIZE:**	A3

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1.3 Requirement for EIAR

Under Section 172 of the Planning and Development Act (the Planning Act), as amended, a planning application for a development which comes within a class of development specified under Schedule 2 of Part 5 of the Planning and Development Regulations must be accompanied by an Environmental Impact Assessment Report. Accordingly, as the proposed development has more than 5 no. turbines and generating capacity of greater than 5MW this proposed development has been subject to impact assessment studies and an EIAR has been prepared in accordance with the Planning Act and Planning and Development Regulations 2001 as amended.

This report constitutes an Environmental Impact Assessment Report (EIAR) in accordance with the Directive 2011/92/EU (the EIA Directive) as amended by Directive 2014/52/EU and complies fully with the EIA Directive as amended.

A Natura Impact Statement (NIS) has also been submitted with this planning application.

1.4 EIAR Methodology and Structure

The Environmental Impact Assessment Report (EIAR) is a report of the effects, if any, which a proposed development, if carried out, would have on the environment. The EIAR provides the Competent Authority and the public with a comprehensive understanding of the project, the existing environment, the likely significant impacts of the project on the environment and the mitigation measures proposed.

The Competent Authority is obliged to carry out an Environmental Impact Assessment (EIA). The obligations imposed on the Competent Authority by the EIA Directive are set out in Part X of the Planning Act.

Article 3 of the EIA Directive as amended states that an *"environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape;

(e) the interaction between the factors referred to in points (a) to (d)"

1.4.1 EIAR Methodology

The EIAR has been prepared in accordance with Directive 2011/92/EU as amended by Directive 2014/52/EU (the EIA Directive). Schedule 6 of the Planning and Development Regulations 2001 (as amended) and Article 5 of the EIA Directive set out the information to be contained in an EIAR.

In addition, in the preparation of this EIAR a scoping of possible impacts of the proposed development was carried out to identify impacts thought to be potentially significant, not significant or uncertain.

Consultation with the relevant private and public agencies ensured that the most significant impacts and the areas of key concern were addressed. Details of the consultation carried out to date for the proposed development are outlined in Chapter 5: EIA Scoping, Consultation and Key Issues of this EIAR.

Schedule 6 of the Planning and Development Regulations 2001 (as amended) describes the information to be contained in an EIAR:

1.

a) A description of the proposed development comprising information on the site, design, size and other relevant features of the proposed development;

b) A description of the likely significant effects on the environment of the proposed development;

c) A description of the features, if any, of the proposed development and the measures, if any, envisaged to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment of the development;

d) A description of the reasonable alternatives studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed development on the environment.

2. Additional information, relevant to the specific characteristics of the development or type of development concerned and to the environmental features likely to be affected, on the following matters, by way of explanation or amplification of the information referred to in paragraph 1:

a) A description of the proposed development, including in particular –

i. A description of the location of the proposed development;

ii. A description of the physical characteristics of the whole proposed development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases;

iii. A description of the main characteristics of the operational phase of the proposed development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used; and;

iv. An estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation) and quantities and types of waste produced during construction and operation phases.

b) A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;

c) A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge;

d) A description of the factors specified in paragraph (b)(i) (I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act likely to be significantly affected by the proposed development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for

example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape;

e) (i) a description of the likely significant effects on the environment of the proposed development resulting from, among other things-

(I) the construction and existence of the proposed development, including, where relevant, demolition works,

(II) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources,

(III) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste,

(IV) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters),

(V) the cumulation of effects with other existing or approved developments, or both, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources,

(VI) the impact of the proposed development on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the proposed development to climate change, and;

(VII) the technologies and the substances used, and;

(ii) the description of the likely significant effects of the factors specified in paragraph (b)(i)(I) to (V) of the definition of 'environmental impact assessment' in section 171A of the Act should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the proposed development, taking into account the environmental protection objectives established at European Union level or by a Member State of the European Union which are relevant to the proposed development;

f) A description of the forecasting methods or evidence used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information, and the main uncertainties involved;

g) A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of an analysis after completion of the development), explaining the extent to which significant adverse effects on the environment are avoided, prevented, reduced or offset during both the construction and operational phases of the development;

h) A description of the expected significant adverse effects on the environment of the proposed development deriving from its vulnerability to risks of major accidents and/or disasters which are relevant to it. Relevant information available and obtained through risk assessments pursuant to European Union legislation such as the Seveso III Directive or the Nuclear Safety Directive or relevant assessments carried out pursuant to national legislation may be used for this purpose, provided that the requirements of the Environmental Impact Assessment Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for, and proposed response to, emergencies arising from such events.

The assessment of environmental impacts has been conducted in accordance with the guidance set out in the following documents:

- *Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017)*
- *Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, Draft, 2017)*
- *Advice Notes for Preparing Environmental Impact Statements (EPA, Draft 2015)*
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018)*
- *Wind Energy Development Guidelines for Planning Authorities (DoEHLG, 2006)*
- *Draft Revised Wind Energy Development Guidelines (DoHPLG, 2019)*
- *European Commission Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment, EU 2013*
- European Commission notice: Guidance document on wind energy developments and EU nature legislation (2020).

The EIAR firstly sets out the planning context, the background to the project, the need for the development, a description of the evolution of the project through the alternatives considered and a description of the proposed development. This sets the reader in context as to the practical and dynamic process undertaken, in order to arrive at the layout and design of the proposed development that will cause least impact on the environment.

Subsequent chapters deal with specific environmental topics for example, traffic & transportation, air quality & climate change, hydrology & water quality, noise, etc. These assessments involve specialist studies and evaluations. The methodology applied during these specific environmental assessments is a systematic analysis of the proposed development in relation to the existing environment. The broad methodology framework for these assessments is outlined below and is designed to be clear, concise and allow the reader to logically follow the assessment process through each environmental topic. In some instances, more specific topic related methodologies are outlined in the relevant chapters of the EIAR.

The broad methodology framework used in all chapters includes:

- Introduction
- Methodology
- Existing Environment
- Potential Impacts
- Mitigation Measures
- Residual Impacts

Introduction

This section generally introduces the environmental topic to be assessed and the areas to be examined in the assessment.

Methodology

Specific topic related methodologies are outlined in this section. This will include the methodology used in describing the existing environment and undertaking the impact assessment. It is important that the methodology is documented so that the reader understands how the assessment was undertaken. This can also be used as a reference if future studies are required.

Existing Environment

An accurate description of the existing environment is necessary to predict the likely significant impacts of a proposed development. Existing baseline environmental monitoring data can also be used as a valuable reference for the assessment of actual impacts from a development once it is in operation.

To describe the existing environment, desktop reviews of existing data sources were undertaken for each specialist area. This literature review relied on published reference reports and datasets to ensure the objectivity of the assessment.

Desktop studies may also be supplemented by specialised field walkovers or studies in order to confirm the accuracy of the desktop study or to gather more baseline environmental information for incorporation into the EIAR.

The existing environment is evaluated to highlight the character of the existing environment that is distinctive and what the significance of this is. The significance of a specific environment can be derived from legislation, national policies, local plans and policies, guidelines or professional judgements. The sensitivity of the environment is also described.

Potential Impacts

In this section, individual specialists predict how the receiving environment will interact with the proposed development. The full extent of the proposed development's potential effects and emissions before the proposed mitigation measures are introduced is outlined here. Potential impacts from the construction, operational and decommissioning phases of the proposed development are outlined. Interactions and cumulative impacts with other environmental topics are also included in this evaluation.

The evaluation of the significance of the impact is also undertaken. Where possible, pre-existing standardised criteria for the significance of impacts will be used.

Such criteria can include Irish legislation, international standards, European Commission and Environmental Protection Agency (EPA) guidelines or good practice guidelines. Where appropriate criteria do not exist the assessment methodology section states the criteria used to evaluate the significance.

Mitigation Measures

If significant impacts are anticipated mitigation measures are devised to minimise impacts on the environment. Mitigation measures by avoidance, by reduction and by remedy can be outlined.

Residual Impacts

The assessment identifies the likely impact that will occur after the proposed mitigation measures have been put in place. These impacts are described in detail and assessment of their significance undertaken.

1.4.2 EIAR Structure

The EIAR has been prepared using the "grouped format structure" as outlined in EPA guidance documents (EPA, 2002; EPA, 2003) and in line with the draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017). The format of this EIAR is designed to ensure that standard methods are used to describe all sections of the EIAR.

Using this structure there is a separate chapter for each topic, e.g. air quality and climate, biodiversity, hydrology. The description of the existing environment, the proposed development and the potential impacts, mitigation measures and residual impacts are grouped in the chapter. The grouped format makes it easy to investigate topics of interest and facilitates cross-reference to specialist studies.

The EIAR consists of the following chapters:

- Chapter 1 - Introduction
- Chapter 2 - Need for the Development and Alternatives Considered
- Chapter 3 - Description of the Proposed Development
- Chapter 4 - Policy
- Chapter 5 - EIA Scoping, Consultation and Key Issues
- Chapter 6 - Air Quality and Climate
- Chapter 7 - Noise and Vibration
- Chapter 8 - Biodiversity
- Chapter 9 - Land, Soils & Geology
- Chapter 10 - Hydrology and Water Quality
- Chapter 11 – Population, Human Health & Materiel Assets
- Chapter 12 – Shadow Flicker
- Chapter 13 - Traffic & Transportation
- Chapter 14 - Archaeology, Architectural and Cultural Heritage
- Chapter 15 - Landscape & Visual
- Chapter 16 - Telecommunications and Aviation
- Chapter 17 - Interactions of the Foregoing

The EIAR is structured as follows:

Volume 1 – Non-Technical Summary (NTS) (including figures)

Volume 2 – Main EIAR

Volume 3 – Appendices to the Main EIAR

Volume 4 – Landscape and Visual Maps and Photomontages

It should also be noted, for the sake of completeness, that a separate Natura Impact Statement (NIS) has also been submitted with the application. An assessment of replant lands at Emlagh, County Clare is included in Appendix 3.3. The application is also supported by Planning Drawings and a Construction Environmental Management Plan included in Appendix 3.1.

1.4.3 Cumulative Impact

The potential cumulative impact of the Project has been assessed in accordance with Annex IV of the EIA Directive as amended which provides that the EIAR must contain a description of the likely significant effects of the project on the environment resulting from the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources.

The assessment of projects cumulatively with other projects has four principal aims:

1. To establish the range and nature of existing projects within the cumulative impact study area of the Project.
2. To summarise the relevant projects which have a potential to create cumulative impacts.
3. To establish anticipated cumulative impact findings from expert opinions within each relevant field. Detailed cumulative impact appraisals are included in each relevant section of the EIAR.
4. To identify the projects that hold the potential for cumulative or in combination effects and screen out projects that will neither directly or indirectly contribute to cumulative or in combination impacts.

The geographic extent of the cumulative assessment is considered on a case-by-case basis, in line with the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission, 1999). Assessment material for this cumulative impact appraisal was compiled on relevant developments within the vicinity of the proposed Annagh Wind Farm project, including the length of the proposed grid connection route and TDR. For the purpose of Cumulative Assessment of Landscape and Visual, all existing and approved wind farms and wind farms pending a decision from the planning authority and An Bord Pleanála within 20km from the outermost turbines of the proposed Annagh Wind Farm were identified for Cumulative Visual Assessment. This study area is in accordance with the Wind Energy Development Guidelines (2006) and is further detailed in Section 15.1.4 of the EIAR. This study area is considered appropriate due to the limited size and extent of the project, the nature of the impacts and the relatively non-sensitive receiving environment.

All existing and approved projects and projects pending a decision from the planning authority and An Bord Pleanála within 20km of the proposed Annagh Wind Farm Development were considered for potential Cumulative Assessment in all chapters of this EIAR. This measurement was taken from the outermost turbines of the proposed Annagh Wind Farm Development and also encompasses the full extent of the GCR and TDR. A 20km distance was considered appropriate due to the limited size and extent of the project, the nature of the impacts and the relatively non-sensitive receiving environment.

All existing and approved projects and projects pending a decision from the planning authority within 250m of the grid route and TDR nodes were considered for potential Cumulative Assessment in all chapters of this EIAR. A 250m distance has been applied to these elements of the project to identify small scale development in proximity to the works proposed at the GCR and the works required along the TDR nodes which may cause potential cumulative impact.

A 250m distance was considered appropriate due to the brief to temporary nature of the works involved on the GCR and TDR and due to the limited extent of the works required.

The material for the cumulative assessment was gathered through a search of relevant County Councils' Online Planning Registers, the An Bord Pleanála website and the EIA Portal. Relevant EIA documents, planning application details and planning drawings were reviewed, which served to identify the locations of existing and approved projects and projects pending a decision from the planning authority, their activities and their environmental impacts.

The relevance of the projects was considered on a case by case basis in each chapter as necessary depending on the interaction and likelihood of cumulative impacts.

The lands at Emlagh, Co. Clare form part of the overall project and relate to replant lands. These, given their location have been assessed in Appendix 3.3 of this EIAR but are considered cumulatively with other elements of the wind farm project in each chapter in the main EIAR.

A full list of projects identified for cumulative assessment using the methodology above is set out in Appendix 1.2 of Volume 3 of this EIAR. Existing and approved projects and projects pending decision from the planning authority and An Bord Pleanála listed in Appendix 1.2 which were found to be relevant for the cumulative assessment throughout the EIAR include:

- Existing Boolard Wind Farm
- Existing Rathnacally Wind Farm
- Consented Solar Farm at the townland of Fiddane – "Charleville Solar"
- Consented Solar Farm at the townland of Ballyroe
- Proposed M20 Limerick to Cork Motorway Project
- Existing and permitted wind farms within 20km of the study area for visual impact assessment

These projects were found to be relevant to the cumulative assessment as potential interactions were identified between the proposed Annagh Wind Farm and these existing, consented and planned projects.

1.4.4 Approach to the Wind Energy Development Guidelines

The proposed Annagh Wind Farm development has been designed in accordance with the current Section 28 Ministerial Guidelines (section 28 of the Planning and Development Act 2000, as amended), Wind Energy Guidelines 2006. We are aware that these guidelines are subject to targeted review. The layout and design of the wind farm has had regard to the provisions of the "Draft Revised Wind Energy Development Guidelines", published by the Department of Housing, Planning and Local Government (December 2019), including a 4x tip-height setback distance (700m) from the proposed turbines to non-financially involved dwellings, applying a zero shadow flicker policy and the aesthetic considerations in the siting and design of the wind farm. The guidance included in the document regarding the submitting of a planning application for wind energy development was also considered in the preparation of this planning submission.

1.5 Contributors to the EIAR

Fehily Timoney and Company (FT) is a consultancy based in Cork, specialising in civil and environmental engineering, and environmental science. FT is well established as a leading consultancy in wind farm development in Ireland. The company has established a professional team specialising in wind farm development. This team has the support of many in-house engineers, scientists and planners.

FT was retained by the applicant to undertake the detailed environmental assessment and prepare the EIAR for the proposed development, as well as preparing the application for consent for submission to Cork County Council.

Specialist and competent experts that contributed to and are responsible for each EIAR chapter/topic are outlined in Table 1-1. Curricula Vitae of contributors are presented in Appendix 1.1 of Volume 3 of this EIAR wherein the competence, experience and relevant qualification(s) for each expert is detailed.

Table 1-1: Contributors to the EIAR

EIAR Topic	Company	Name and Qualifications
Chapter 1 – Introduction	FT	Eamon Hutton, BSc, MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 2 - Need for the Development and Alternatives Considered	FT	Eamon Hutton, BSc MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 3 – Description of the Development	FT	Eamon Hutton, BSc MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 4 – Policy	FT	Eamon Hutton, BSc MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 5 – EIA Scoping, Consultation and Key Issues	FT	Eamon Hutton, BSc, MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 6 – Air Quality and Climate	FT	Donna O' Halloran, Dip Hort., BSc Agr., MSc (Agr) ERM, MSc Ecology (Co-author and Reviewer) Eoghan O'Sullivan, BE (Co-author)
Chapter 7 – Noise and Vibration	FT	Maureen Marsden, Meng (Co-author) Dr. John Mahon, PhD BA BAI, MIEI, MIOA (Co-author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 8 – Biodiversity	FT	Ben O'Dwyer, BSc. Wildlife Biology (Author) Rita Mansfield, BSc. Applied Ecology; H. Dip Environmental Protection and Pollution Control (Reviewer)
Chapter 9 – Land, Soil & Geology	FT	Ian Higgins, BSc, MSc (Author) Tom Clayton CEng, MEng (Reviewer)

EIAR Topic	Company	Name and Qualifications
Chapter 10 – Hydrology and Water Quality	FT	Kristian Divjak MSc, B.Eng (Author) Trevor Byrne, BSc, MSc, MIEI (Reviewer)
Chapter 11 – Population, Human Health & Material Assets	FT	Eamon Hutton, BSc MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 12 – Shadow Flicker	TNEI Services Ltd	Mark Tideswell, BSc, Dip, AMIOA (Co-author) Jim Singleton, BSc, Dip, AMIOA (Co-author, Reviewer)
Chapter 13 – Traffic and Transportation	FT	Trevor Byrne, BSc, MSc, MIEI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 14 Archaeology, Architectural and Cultural Heritage	John Cronin & Associates	Tony Cummins, BA, MA (Author) John Cronin, BA, MRUP, MUBC (Reviewer)
Chapter 15 – Landscape and Visual	Macro Works	Richard Barker BA PG Dip MLA (Co-author and Reviewer) Jamie Ball BALA, MILI (Author)
Chapter 16 – Telecommunications and Aviation	FT	Eoghan O'Sullivan, BE (Co-author) Eamon Hutton, BSc, MSc, MIPI (Co-author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)
Chapter 17 – Interactions of the Foregoing	FT	Eamon Hutton, BSc, MSc, MIPI (Author) Jim Hughes, BA, EIA/SEA Dip, MSc (Reviewer)

1.6 Permission Period

A ten-year consent is being requested for this development. That is, planning consent for the construction of the development would remain valid for ten years following the grant of permission. We note that the Wind Energy Development Guidelines (2006) state that "Planning Authorities may grant permission for a duration longer than 5 years if it is considered appropriate, for example, to ensure that the permission does not expire before a grid connection is granted. It is, however, the responsibility of the applicants in the first instance to request such longer durations in appropriate circumstances". This text also appears in section 7.22 of the Draft Revised Wind Energy Development Guidelines (2019).

A 10-year planning permission is considered appropriate for a development of this size to ensure all consents are in place. The expected physical lifetime of the proposed candidate turbine is approximately 35 years.

After this time, the developer will make a decision whether to replace the turbines (subject to obtaining the necessary permission) or decommission the turbines, as is proposed in this application.

It should be noted that section 7.20 of the Wind Energy Development Guidelines (2006) includes for the following:

> *'The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances'*

In this respect, the applicant requests the grant of permission is on the basis of a 35-year operational period from the date of full operational commissioning of the wind farm.

1.7 Difficulties Encountered

There were no difficulties encountered during the preparation of this EIAR.

1.8 Viewing and Purchasing of the EIAR

Copies of this EIAR including the Non-technical Summary and the Appendices may be inspected free of charge or purchased by any member of the public during normal office hours at Cork County Council Planning Department:

- Planning Department, Ground Floor, County Hall, Carrigrohane Road, Cork.

1.9 References

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 2 – SITE SELECTION & ALTERNATIVES CONSIDERED

Prepared for: EMPower

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2. SITE SELECTION & ALTERNATIVES

2.1 Introduction

The following chapter sets out the need for the proposed development having regard to climate change, national policy and national renewable energy targets. Following the establishment of the need for the proposed development, the chapter details the reasonable alternatives studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. It describes the site selection process, alternative design philosophies considered, alternative site layouts, the do-nothing alternative and alternative processes, amongst other things.

2.2 Need for the Proposed Development

The proposed Annagh Wind Farm is necessary to produce renewable energy for the Irish national grid in order to transition Ireland to a low carbon economy. The proposed wind farm has an estimated capacity of approximately 37.2MW. The project will play a role in providing renewable electricity in the Republic of Ireland, accounting for approximately 0.86% of the current installed wind energy capacity (Wind Energy Ireland, 2021).

At a strategic level, the need for the Project is supported by International, European, and National environmental and energy commitments and policies. In Chapter 4 of this EIAR, a detailed analysis of these commitments and policies is outlined. The Irish Government published the Climate Action Plan in June 2019 (DoCCAE, 2019) which sets actions to ensure Ireland's 2030 renewable energy targets can be achieved. This is in the context of substantial and continuing failure by Ireland in meeting climate targets to date.

The Climate Action Plan (2019) recognises that Ireland must make a significant increase in the current levels of renewable energy production in the country. A press release accompanying the Climate Action Plan (CAP), titled 'Giving Ireland a Sustainable Future' (DoCCAE, 2019a) states that:

> *"We should be radically reducing our reliance on carbon; Ireland's greenhouse gas emissions have been rising rapidly. We are currently 85% dependent on fossil fuels. We have a short window of opportunity to reverse this trend and secure a better, healthier, more resilient future for the country…This plan identifies how Ireland will achieve its 2030 targets for carbon emissions and puts us on a trajectory to achieve net zero carbon emissions by 2050."*

2.2.1 Climate Change

The scientific community and governments across the world are in agreement that the global climate is changing. This is due to human activities which have significantly contributed to natural climate change through our emissions of greenhouse gases. This interference is resulting in increased air and ocean temperatures, drought, melting ice and snow, rising sea levels, increased rainfall, flooding and other influences (EPA, 2021).

The current Taoiseach Michéal Martin on the launch of the Climate Action and Low Carbon Development (Amendment) Act (2021) remarked that:

> *"The impact of our actions on the planet is undeniable. The science is undisputed. Climate change is happening. And we must act." (Government of Ireland, 2020)*

In this regard, the Government of Ireland enacted the Climate Action Plan (CAP) in June 2019 and more recently, the Climate Action and Low Carbon Development (Amendment) Act 2021. The CAP sets out actions to cut emissions and make Ireland a zero-carbon economy by 2050. The Climate Action and Low Carbon Development (Amendment) Act 2021 will establish a legally binding framework with clear targets and commitments set in law, and ensure the necessary structures and processes are embedded on a statutory basis to ensure Ireland achieves its national, EU and international climate goals and obligations in the near and long term through a process of carbon budgeting.

It is estimated that the capacity of approximately 37.2MW of electricity from the proposed Annagh Wind Farm will result in the net displacement of approximately 42,966 tonnes of CO2 per annum, as detailed in Chapter 6: Air and Climate.

This is in line with the targets of the CAP which:

> "identifies how Ireland will achieve its 2030 targets for carbon emissions, and puts us on a trajectory to achieve net zero carbon emissions by 2050" (DoCCAE, 2019a)

Greenhouse gases and other emissions from fossil fuels give rise to global warming, acid rain and air pollution. Fossil fuels still dominate Ireland's electricity production. The proposed Annagh Wind Farm will provide renewable energy to the national grid with minimal impact on the environment, offsetting the need for burning of fossil fuels. This is necessary to meet the challenges of future climate change.

The Department of Communications, Climate Action and Environment stated that:

> "climate disruption is already having diverse and wide-ranging impacts on Ireland's environment, society, economic and natural resources. The Climate Action Plan clearly identifies the nature and scale of the challenge." (DoCCAE, 2019)

The proposed Annagh Wind Farm will assist in mitigating the effects of climate breakdown and help Ireland achieve its climate neutral economy no later than 2050, to be known as the 'national climate objective', as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021. Furthermore, the Climate Action Plan seeks a total installation of 8.2 GW of onshore wind capacity by 2030. The Annagh Wind Farm has the potential to contribute to approximately 0.45% of this 2030 national target.

2.2.2 EU Renewable Energy Targets and National Policy

As further detailed in Chapter 4 of this EIAR, Ireland has adopted binding agreements to reduce dependency on fossil fuels and increase energy production from sustainable sources, creating a requirement for the nation to transition to a low carbon economy.

This is supported by the latest Programme for Government (2020) 'Our Shared Future' which presents strong climate governance in rapidly reducing climate change in order to protect and improve public health and quality of life. The government are committed to rapid decarbonisation of the energy sector with an aim of providing the necessary actions to deliver national renewable electricity targets.

The 2030 Climate and Energy Framework (European Commission, 2014) adopted by the EU sets out a framework for the long-term perspective beyond 2020 targets. The 2030 Climate and Energy Framework sets out three key targets for the year 2030:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share of renewable energy
- At least 32.5% improvement in energy efficiency.

Further to this the European Commission in 2016 published its 2030 emissions targets break down for each Member State. While the overall EU target is a reduction of 40% on 1990 greenhouse gas emissions by 2030, every Member State negotiates an individual target. Ireland will have to reduce its emissions by 30% relative to its 2005 emissions.

The 2050 "Roadmap for a competitive low-carbon Europe" (European Commission, 2011) suggests that by 2050, the EU should cut greenhouse gas emissions to 80% below 1990 levels. This would require 40% emissions cuts by 2030 and 60% by 2040. This is in line with EU leaders' commitment to reducing emissions by 80-95% by 2050. Ireland is likely to face equivalent mandatory targets from the EU.

Ireland has adopted these targets into the Climate Action Plan (2019) which includes a target to increase electricity generated from renewable sources to 70% by 2030. This will require doubling Ireland's production of electricity from renewable sources, which stood at 36.5% in 2019 (SEAI, 2020). The 2030 target sets out the pathway to the goal of net zero greenhouse gas emissions by 2050.

To achieve 70% renewable energy production by 2030, substantial new development will be required. The CAP sets out targets as follows which rely heavily on wind energy technology:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections;
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation;
- Increase electricity generated from renewable sources to 70%, indicatively comprised of:
    - at least 3.5 GW of offshore renewable energy
    - up to 1.5 GW of grid-scale solar energy
    - up to 8.2 GW total of increased onshore wind capacity.

The binding EU targets have been transposed into Irish National Policy in the 2019 Climate Action Plan which focuses a large amount of future electricity production on the wind energy sector. This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Annagh Wind Farm in reaching both EU and national renewable energy targets.

2.2.3 Energy Security

Secure supplies of energy are essential for Ireland's economy and for maintaining safe and comfortable living conditions. Energy import dependency is a significant indicator of the country's energy security. Ireland is one of the most energy import-dependent countries in the European Union, importing 67% of its fuel in 2018 at an estimated cost of €5 billion (SEAI, 2020a). The largest share of energy imports in 2018 was oil, accounted for 73% of total energy imports, natural gas 17%, coal 8.2% and renewables 1.4%. Import dependency increased to 69% in 2019 (SEAI, 2020).

Price volatility of fossil fuels may increase as carbon prices escalate in the future. The cost of carbon credits is included in all electricity trade, and the price of electricity generated by coal is particularly vulnerable due to the high carbon emissions per unit of electricity generated. Coal still generates a significant amount of Ireland's electricity with 7% of electricity produced by coal in 2018 (SEAI, 2020) down from 18.3% in 2017 (SEAI, 2018). However, the previous programme for government called for a review of options to replace coal with low carbon alternatives within a decade as reflected in the CAP (2019). As a result, coal accounted for 2% of net imports in 2019, while gas imports have increased due the decline in production of the Corrib gas field, and oil imports have remained steady (SEAI, 2020).

The Energy White Paper, Ireland's Transition to a Low Carbon Energy Future 2015-2030 (DoCENR, 2015) sets out a framework to guide policy and actions that the government intends to take in the energy sector. The paper notes that "There will be substantial increases in the cost of carbon in the short and medium term, through the EU Emissions Trading Scheme". The electricity produced by the proposed Annagh Wind Farm will reduce dependence on imported fossil fuels and add to financial autonomy and energy stability in Ireland, further emphasising the need for the proposed development.

Furthermore, the EU have rewritten the energy policy framework in the Clean Energy for all Europeans Package (2019). Member states must meet new commitments to improve energy efficiency and the take-up of renewables in their energy mix by 2030. For example, the new rules on the electricity market, which have been adopted, will make it easier for renewable energy to be integrated into the grid, encourage more inter-connections and cross-border trade, and ensure that the market provides reliable signals for future investment. This EU policy framework encourages energy security for all EU member states, emphasising a need for renewable energy and a move away from fossil fuels.

2.2.4 Competitiveness of Wind Energy and Economic Benefits of the Annagh Wind Farm

In addition to helping Ireland reduce environmentally damaging emissions and helping avoid significant fines from the EU, the Annagh Wind Farm will also contribute positively to the national and regional economy.

SEAI, in its report Energy in Ireland (SEAI, 2020), indicated that in 2019 wind energy:

- Generated 32% of all electricity;
- Avoided 3.9 million tonnes of CO^2 emissions; and
- Avoided approximately €260 million in fossil fuel imports.

Additionally, a report published by Barringa in January 2019 states that:

> *"Our analysis indicates that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year."* (Baringa, 2019).

Notwithstanding the above financial costs and benefits, the Barringa report outlines that wind generation in Ireland avoids:

> *"33 million tonnes of power sector CO2 emissions. The total carbon emissions from electricity generation in 2017 was 11.7 Mt, so a saving of 33 Mt is equivalent to almost 3 years of total carbon emissions in the electricity sector today. 137 TWh of fossil fuel consumption at a saving of €2.7bn. In comparison, Ireland consumed 44 TWh (3814 ktoe) of fossil fuels for electricity generation in 2017, so a saving of 137 TWh is equivalent to 3 years of current fossil fuel consumption for electricity generation."*

In conclusion, the need for the Annagh Wind Farm development is a result of the need for action to fight against climate change by reducing consumption of fossil fuels. Ireland has accepted this need in entering into binding renewable energy targets with the European Union with an overall aim to become carbon neutral by 2050. The government has indicated that wind energy will play a key role in providing renewable electricity to the national grid. This will comprise of an increase of 8.2GW of onshore wind capacity by 2030 (DoCCAE, 2019). The Annagh Wind Farm has potential to contribute to approximately 0.45% of this 2030 target by providing approximately 37.2MW of renewable electricity. The increase in domestic renewable energy as a result of the Annagh Wind Farm will also assist Ireland in improving resilience in energy security by reducing the requirement for import of fossil fuels.

2.3 Alternatives Considered

The requirement in relation to alternatives in the EIA process is set out in Directive 2011/92/EU, amended by Directive 2014/52/EU, in Article 5 (1)(d), which states that an EIAR should include:

> *"a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment" Article 5(1)(f) of the EIA Directive requires that the EIAR contains "any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected."*

Annex IV of the EIA Directive states that the information provided in an EIAR should include a;

> *"description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

This section has particular regard to the environmental considerations which influenced the selection of alternatives and details the evolution of the proposed project through alternatives considered, indicating the main reasons for selecting the chosen option taking into account the effects of the proposed project on the receiving environment and considering the comparison of environmental effects of each alternative.

The alternatives considered have been described in line with the draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (2017). The draft Guidelines state that:

> *"It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."*

Furthermore, the draft Guidelines note the following regarding high level plans and strategies which may influence or pre-determine decisions in the development process:

> *"Higher level alternatives may already have been addressed during the strategic environmental assessment of relevant strategies or plans. Assessment at that level is likely to have taken account of environmental considerations associated. Thus, these prior assessments of strategic alternatives may be considered and referred to in the EIAR."*

The section also details non-environmental factors of the development process where they are relevant to the evolution of the proposed project.

2.3.1 Do-Nothing Alternative

As set out in section 2.2.2, Ireland has binding targets set by the EU. Ireland is obliged to ensure that 32% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030 and reduce its greenhouse gas emissions by 40% by 2030, relative to its 1990 levels, with an overall objective of carbon neutrality by 2050. This is in order to help reduce the nation's CO2 emissions and to promote the use of indigenous renewable sources of energy. These targets have been incorporated into national policy in the Climate Action Plan (2019) which aims to:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections;
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation; and
- Increase electricity generated from renewable sources to 70%
    - Indicatively comprising up to 8.2 GW total of onshore wind capacity.

Furthermore, the Climate Action and Low Carbon Development (amendment) Act 2021 will act to reduce 51% emissions over a ten year period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050.

Under the "Do-Nothing" scenario, the Annagh Wind Farm project would not go ahead, the development of a renewable energy project is not pursued, and the site remains in use as agriculture and forestry.

In the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Cork's wind energy resource would be lost at this site.

The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and National targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The proposed wind farm has the potential to prevent approximately 42,966 tonnes of CO2 emissions per annum, or up to 1,503,810 tonnes of C02 over the 35-year expected lifespan of the project. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. This may result in continued global warming and impact upon the intention to "pursue efforts" to limit warming as agreed to in the Paris Agreement (2015). This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2020 – 2029 (Eirgrid, 2020), the growth in energy demand for the next ten years on the Island of Ireland will be between 17% and 41%. In the 'Do-nothing' scenario, importation of fossil fuels to maintain growing energy supply will continue and Ireland's energy security will remain vulnerable. A "Do-nothing" scenario would contribute to strain on existing energy infrastructure and may impact on economic growth if energy demand cannot be met. This may be exacerbated by the government's plans to cease the burning of coal at Moneypoint as well as the termination of all peat burning at Bord na Móna's powerplants by 2023.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the proposed development will be lost. These benefits include between 36 and 40 no. jobs during the construction phase of the project, and between 10 and 13 long-term jobs once operational. Furthermore, under the "Do-Nothing" scenario the local community will not benefit economically from the community benefit fund associated with the project which could be used to improve physical and social infrastructure in the area of the wind farm site.

In the "Do-Nothing" scenario, the potential environmental impacts of the proposed development as set out throughout this EIAR will not occur. Table 2-1 sets out the potential impacts of the 'do-nothing scenario' compared to the residual impacts associated with the Annagh Wind Farm Project in relation to the various environmental topics covered in the individual chapters of this EIAR. Refer to each respective chapter for full details of residual impacts.

Table 2-1: Comparison of Potential Residual Environmental Effects - Project vs. 'Do-nothing'

Environmental Consideration	Residual Impact of the Proposed Project	'Do-noting' Alternative
Air & Climate	Slight to moderate temporary localised residual impacts arising from fugitive dust emissions. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of 42,966 tonnes of CO2 per annum.	Fossil fuel power stations will likely be the primary alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise & Vibration	Not significant to slight temporary noise impacts associated with construction activities.	Neutral

Environmental Consideration	Residual Impact of the Proposed Project	'Do-noting' Alternative
	Temporary significant impact along the grid route at certain dwellings during construction. Long-term slight to moderate negative impact on the dwellings closest to the project as a result of the operational phase.	
Biodiversity	Slight to imperceptible negative impact on certain species and habitat. Potential moderate negative reversable local impact on bats.	Neutral
Ornithology	Slight-Imperceptible Reversible Residual Impact on birds.	Neutral
Land, Soils, Geology	Imperceptible residual impact following implementation of mitigation measures. Slight residual cumulative effects from the excavation of fill material from local quarries.	Neutral
Hydrology & Water Quality	Non-significant impacts following implementation of mitigation measures.	Neutral
Population & Human Health	Long-term slight to significant positive economic benefit to local area due to job creation and community benefit fund.	No economic benefit for the local area due to no provision of community benefit fund. No employment opportunities as a result of the construction operation and decommissioning of the project. No positive benefit to recreation facilities.
Material Assets	Long-term slight positive residual impact on non-renewable resources by offsetting the use of fossil fuels in electricity generation. Slight positive residual impact on electricity infrastructure in the area of the wind farm site. Slight negative impact to capacity of licenced waste facilities.	No offset to fossil fuel use. No provision of additional electricity infrastructure in the local area. No slight negative impact to capacity of licenced waste facilities.
Traffic & Transport	Temporary slight impact due to construction activities.	Neutral
Archaeology & Cultural Heritage	No residual impacts envisaged that cannot be reversed following decommissioning.	Neutral
Landscape & Visual	Slight to moderate visual impact, subject to viewshed as assessed in Chapter 15.	Neutral
Telecoms & Aviation	No residual Impact expected.	Neutral

2.3.2 Project Site Selection Process

The following details the EMPower project screening and project selection process. An examination of several potential alternative project locations was also carried out. In locating potential projects, EMPower carried out a geographical information system (GIS) screening exercise in 2018 across the entire country.

This exercise utilised a larger number of spatial datasets such as ordnance survey land data, house location data, transport, forestry data, existing wind energy and grid infrastructure data and environmental data such as ecological designations, landscape designations and wind energy strategy designations available at the time. The site selection exercise was carried out throughout Ireland, however, for the purpose of this section we focus on sites identified in the South West Region, i.e. Counties Cork and Kerry. This is in order to provide alternatives relative to the proposed Annagh Wind Farm site.

Residential and commercial building locations were attained from Eircode's database of 2.2 million address points in Ireland. A buffer of 500m was applied to each building point, provisionally ensuring an adequate setback distance from each dwelling ensuring compliance with all relevant wind energy guidelines. As potential Study Area assessments progressed this dwelling setback distance was further refined to comply with project and area specific details. The 2018 EMPower GIS screening process outlined certain areas that warranted further study and some areas were not considered for further study.

Study Areas not selected for further study were largely excluded because of some or all the following:

- Wind Speeds available;
- Proximity to existing grid connection points;
- Airport proximity;
- Existing electrical generation, grid upgrades and electrical loads in the area;
- Environmental designations and sensitivities;
- Existing planned and permitted projects;
- Tourism amenity;
- Topography;
- Access route availability;
- Water bodies;
- Land use and number of landowners.

As part of EMPower's 2018 Project Screening Process, areas of the South West Region were examined for potential to accommodate wind energy projects. County Cork was examined with a focus on developing sites within Cork County Council's designated areas of 'Acceptable in Principle' and areas 'Open to Consideration', as illustrated in Figure 9.3 of the Cork County Development Plan (2014). Sites identified within these designated areas were brought forward for further consideration. Furthermore, areas of County Kerry designed 'Open to Consideration' or 'Strategic Site Search Area' were also examined to accommodate a wind energy project.

Derrincullig

A potential project at Derrincullig located within an area designated "Open to Consideration" was examined during the site selection process. This is a mountainous area bordering counties Kerry and Cork. This site is in the vicinity of several existing wind farms, including Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms.

There was a planning application for a wind energy project previously submitted (partly) on these lands which was refused by Kerry County Council and An Bord Pleanála in 2013 and 2014 respectively.

Reasons cited in the refusal included the visual impact that the project would have on the landscape. Although this site is in the "Open to Consideration" zone and it may be possible to minimise the visual influence on the landscape through layout design, the proposed Annagh Wind Farm project is deemed to be of less impact and a preferable development opportunity.

Killognaveen

The Killognaveen site is located due east of the town of Cahersiveen in South Kerry. It is located within Kerry County Council's "Open to Consideration" wind development zone and benefits from an excellent wind resource. The site is located within 5km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC. In addition, the site is situated 34km from the nearest substation, Oughtragh 110kV substation, which may present economic challenges concerning grid connection as well as potential impact on roads, traffic and transportation. For these reasons, the proposed Annagh Wind Farm project is considered to have lesser environmental impact and presents a more technically feasible alternative.

Knockmanagh

The 2018 project screening process showed the Knockmanagh site, which is located approximately 7.5km due north-east of Killarney, to have strong wind resource and a relatively large contiguous buildable area. This is a rare combination given the housing density of many parts of rural Ireland. The site is also situated within close proximity to Knockearagh substation. However, the site falls outside Kerry County Council's "Strategic Site Search" and "Open to Consideration" wind development zones and would be clearly visible from areas of Killarney National Park and the Mcgillicuddy's Reeks mountain range, two visually sensitive areas of national importance. The proposed Annagh Wind Farm project was therefore considered an alternative with less potential visual impact than the Knockmanagh site.

Annagh

The proposed Annagh Wind Farm project is located approximately 3 km North of Churchtown and 5 km South West of Charleville in County Cork. The region is situated in Cork's County Council's ''Open to Consideration'' Zone for Wind Energy Development and is situated in a mainly flat rural landscape, with a mix of agricultural and forestry lands. The proposed Annagh Wind Farm project's comparative advantage is demonstrated across numerous categories as set out in Table 2-2. Based on the analysis completed, it was deemed to present one of the most viable opportunities from a technical, financial, and planning perspective, while imposing the least impact on its receiving environment, in comparison to the alternative sites considered above.

Table 2-2: Examination of Alternative Sites

	Derrincullig	Killognaveen	Knockmanagh	Annagh
Number of Turbine Units	13	11	19	6
CDP Wind Dev. Zone	Open to Consideration	Open to Consideration	Unsuitable	Open to Consideration
Wind Resource	Class 2	Class 2	Class 2	Class 2/3
Designated sites	Situated within 2km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Situated within 2km of the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Situated 2.6km from the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.	Situated within 1km of the Blackwater River (Cork/Waterford) SAC.
Tourism	High – Visual impact sited as reason for refusal of previous planning application on site.	High – Views possible from the Mcgillicuddy's Reeks.	Views possible from Macgillicuddy's Reeks and Killarney National Park.	Low - Slight impact to amenity features in the area of the wind farm site.
Ornithology risk	High – Eagle activity sited as reason for refusal in previous planning application.	Medium – Area not known to have Annex 1 birds present.	Medium - Area not known to have Annex 1 birds present.	Low - Slight-Imperceptible Reversible Residual Impact on birds.
Grid risk	Medium – Numerous existing and under construction wind farms in the vicinity. Clonkeen substation located 7km from site.	High – 34km to Oughtragh 110kV substation, need for deep connection works. Potential significant impact on roads during construction.	Low – 5km north of Knockearagh substation where available capacity exists.	Low – 3.3km from Charleville Substation. Slight short-term impact on public road.
Planning precedence in area	Coomagearlahy 1,2 and 3, Midas and Grousemount Wind Farms in the vicinity. There was also a previous application submitted including lands within this site, which was refused by Kerry County Council and	Cahirciveen project located 1.5km from Killognaveen site.	Barna Wind Farm 8km East. Reduced potential for cumulative impact at this site.	4 no. turbines located within 3km of the wind farm site. Boolard Wind Farm (2 turbines) and Rathnacally Wind Farm (2 turbines).

	Derrincullig	Killognaveen	Knockmanagh	Annagh
	An Bord Pleanála in 2013 and 2014 Respectively.			
Terrain / Land use	Mountainous, bog, agricultural	Rural general, peat harvesting, bog	Rural general, peat harvesting, bog	Strong rural area, agriculture and forestry.
Housing Density	Low	Medium	Medium	Low

The sites considered for a wind energy development as detailed in Table 2-2 presented a range of different environmental constraints and sensitivities. When compared, the Annagh site was found to have the greatest capacity for a wind energy development due to its robust receiving environment and lack of significant environmental constraints.

The results of EMPower's 2018 project screening process identified several potential sites throughout the South West Region which were deemed suitable for potential wind energy development according to relevant planning guidelines.

A selection of sites that emerged from the 2018 project screening process, outlined above, for which EMPower are processing separate planning applications including Environmental Impact Assessments are:

- Shronowen, Co. Kerry
- Ballynagare, Co. Kerry
- Annagh, Co. Cork (proposed project).

Empower intend to bring forward each of the above projects as viable wind energy projects. Each will be subject to separate EIA's. As such a description of the reasonable alternatives studied which are relevant to each project and its specific characteristics, together with an indication of the main reasons for selecting the chosen option regarding their environmental impacts will be provided in the EIAR accompanying the applications for same.

Without carrying out a detailed project screening and viability process, as outlined, EMPower could bring forward a proposed project that may not be best suited for Wind Energy Development. This would mean that there would be a potential for the construction and operation of this hypothetical wind energy development to have an adverse effect on ecologically designated or sensitive areas and visually sensitive (scenic) or amenity areas. There could also be the potential for greater shadow flicker, noise and traffic impacts if the selected site was located in an area with a higher number of residential dwellings. Also, a site with low average wind speed and/or greater distance to suitable grid infrastructure may not be economically viable.

EMPower continuously assesses lands for renewable energy opportunities and other potential project study areas can emerge periodically.

2.3.3 Annagh Wind Farm – Project Suitability

Once the Annagh project Study Area was selected from the 2018 project screening process it was further examined in the context of the following elements which are considered decisive in determining viability for a wind farm project:

- Planning Policy;
- Designated Sites;
- Population Density;
- Wind Speed; and
- Access to the National Grid.

2.3.3.1 Planning Policy

The Department of Housing, Planning and Local Government's Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (2018) and the Environmental Protection Agency document 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (Draft, EPA, 2017) state that it is important to acknowledge the existence of difficulties and limitations when considering alternatives.

The Draft Guidelines state:

> *"Alternatives may be identified at many levels and stages during the evolution of a project, from project concepts and site locations, through site layouts, technologies or operational plans and on to mitigation and monitoring measures. The alternatives that are typically available for consideration at the earlier stages in the evolution of a project generally represent the greatest potential for avoidance of adverse effects."*

Section 3.4 of the Draft Guidelines is concerned with the Consideration of Alternatives, and states that:

> *"Higher level alternative may already have been addressed during the strategic environmental assessment of strategies or plans. Assessment at that level is likely to have taken account of environmental considerations associated for example with the cumulative impact of the area zoned for industry on a sensitive landscape. Note also that plan-level/higher-level assessments may have set out project level objective or other mitigation that the project and its EIAR should be cognisant of. So, at EIA level this prior assessment of strategic alternatives informs the EIAR"*

Development Plans and Regional Plans provide a strategic framework and policy context for all planning decisions. The Planning and Development Act 2000, as amended (Government of Ireland, 2000-2019) reinforces the role of the Development Plan as the primary strategic statement on land-use planning at city, town and county levels, and provides a clear defined context for the formulation and content of planning applications. Study Areas which EMPower identified for potential wind energy developments were screened against policy designations as listed below.

Key policies of the Cork County Development Plan (2014) identified include the following:

- Wind Energy Development Zonings;
- Landscape Character Assessments;
- Sensitive Landscape Designations; and
- Cultural Heritage Sites.

As set out in Section 4.6 of this EIAR, the Cork County Development Plan policy supports the development of Wind Energy projects in appropriate areas. The subject site was found to be in an area designated in the Cork County Development Plan as being 'Open to Consideration' for wind energy development. The site falls within Landscape Character Type 5: 'Fertile Plain and Moorland Ridge'. The landscape value and sensitivity is considered to be very high in this landscape type, however, as detailed in Chapter 15, there are no significant landscape features or scenic routes in proximity to the proposed wind farm site. A study of cultural heritage sites was conducted which identified no major constraints with respect to architectural heritage and protected monuments.

With respect to County Development Plan designations, the subject site was considered feasible for wind energy development.

2.3.3.2 Natura 2000 Sites

It is preferable that wind energy development is not located in an area designated as a Special Area of Conservation (SAC), Special Protected Area (SPA) or Natural Heritage Area (NHA). The proposed Annagh Wind Farm site is not located within an SAC, SPA or NHA, however, the subject site was found to be in proximity to the Blackwater River (Cork/Waterford) SAC (002170). With respect to the conservation objectives for this Natura 2000 site, it was considered that a wind energy project could be developed at the subject site without causing negative impacts to the designated site, through provision of mitigation measures to prevent hydrological changes and impacts such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses. Mitigation measures are set out in Chapter 8: Biodiversity and Chapter 10: Hydrology & Water Quality. A Natura Impact Statement has been prepared for the proposed development which concludes beyond reasonable scientific doubt that the integrity of the Blackwater River (Cork/Waterford) SAC will not be adversely affected.

2.3.3.3 Population Density

Areas with low housing density are preferable for wind energy development so as to minimise potential disturbance to residential amenity which may be caused as a result of construction activities, as well as visual impacts, shadow flicker and noise during the operational phase. As discussed in Section 11.3 of this EIAR, the population of the Wind Farm Site Area[1] was found to be far below the state average and below the Cork County average, as detailed in Table 2-3 below. Population density of the study area is illustrated in Figure 11-3 in Chapter 11 of this EIAR.

[1] The study area includes the electoral divisions which the Wind Farm Site, Grid Route Connection and Turbine Delivery Route fall within, as defined in Section 11.3 of this EIAR

The low population density of the study area provides greater capacity for wind energy development at the Annagh Wind Farm Site, allowing for greater number of turbines to be constructed while maintaining appropriate setback distances from dwellings as set out in the Wind Energy Development Guidelines.

Table 2-3: Population Density

Area	Population Density (Persons per square kilometre) 2016
State	67.8
Cork County	55.6
Wind Farm Site Area	26.3

2.3.3.4 Other Considerations

Wind speed was assessed at the site in order to determine if wind energy development would be feasible. Wind speed analysis is available from the Sustainable Energy Authority of Ireland (SEAI). Wind speed at the subject site is above average. Average wind speeds at a height of 100 meters are recorded at 7.4 and 7.5 meters per second according to SEAI data. This indicates viable values for wind energy development at this location, considering values of 3-5 meters per second are required for turbines to start operating. The wind resource at the Annagh Wind Farm site is illustrated in Figure 2-1.

The subject site is in proximity to a primary transport routes, the N20 national primary route located approx. 4km to the east of the site at Ballyhea. This route is well connected to the national road network. Local road L1322 leading from the N20 to the site is of good quality and capacity but will require minor upgrades to facilitate construction turbine deliveries as detailed in Chapter 3 and further detailed in Chapter 13 of this EIAR.

Grid constraints were also considered during the strategic site selection process as detailed in the project site selection process in Section 2.3.2. The Annagh site was found to be in proximity to the Charleville 110kV Substation on the national transmission system, located 3.3km from the site entrance by public road. Capacity at the substation was examined, and potential routes were identified and assessed in order to determine a viable connection from the proposed Annagh Wind Farm Site to the national grid. This is further addressed in Section 2.3.5.3.

In summary a project site screening exercise was undertaken. This resulted in a short list of viable sites as detailed in section 2.3.2. Further detailed considerations including planning policy, proximity to designated sites, population density, wind resource and grid connection capacity. These were examined for the Annagh site which indicated viability for a wind energy development at the site.

While the outcome of the site screening process has identified the site of the current proposal as a suitable location for a wind farm development of the nature proposed, it does not preclude other sites within EMPower's portfolio being brought forward for further consideration in the future.

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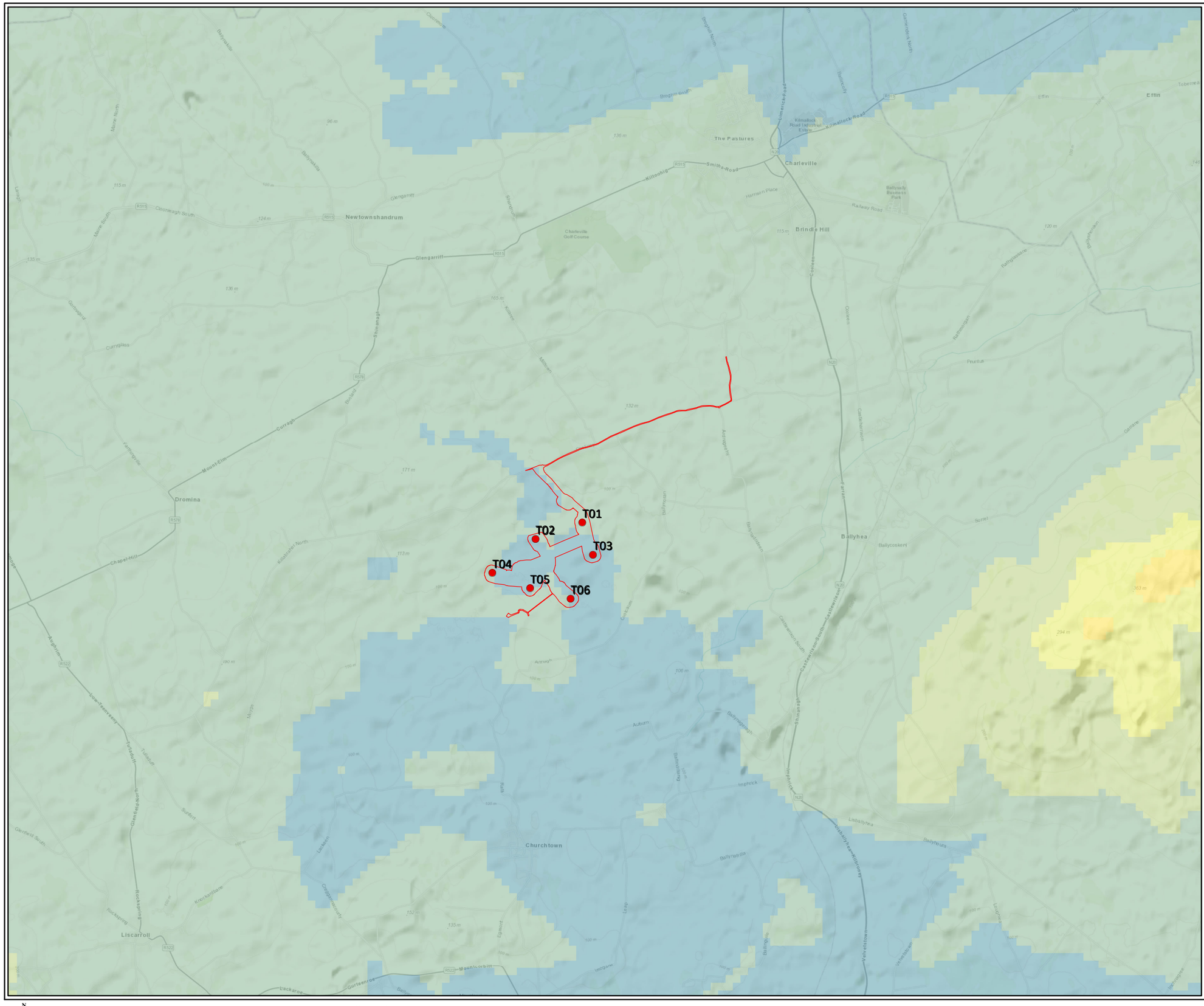

Legend

- Site Boundary
- Turbine Layout

Wind Speed 100m (m/s)

- 6.7 - 7.5
- 7.6 - 8.2
- 8.3 - 9
- 9.1 - 9.7
- 9.8 - 10.2

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TITLE:	Wind Speed		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.1		
CLIENT:	EMPower		
SCALE:	1:50000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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2.3.4 Alternative Layouts

Alternative layouts for the proposed wind farm were developed in an iterative design process which aimed to avoid environmental sensitivities, minimise potential environmental impacts both on and off site and to maximise the wind potential on site. The design has been carried out in accordance with industry guidelines and best practice, namely the Department of Environment, Heritage and Local Government's (DoEHLG) Wind Energy Development Guidelines (2006), The Department of Housing, Planning and Local Government's (DoHPLG), and the Irish Wind Energy Association Best Practice Guidelines (2012). The design process of the project has had regard to the Draft Revised Wind Energy Development Guidelines (2019) in the aesthetic considerations in the siting and design of the wind farm and in terms of mitigation by design including increased setback from nearby dwellings and the policy regarding zero shadow flicker. The layout and design was an iterative process which took account of such criteria as:

- Set back from houses;
- Set back from designated sites;
- Set back from other constraints such as watercourses, public roads and power lines;
- Suitable wind speeds;
- Landscape and visual sensitivity;
- Ecology;
- Ornithology;
- Soils and Geology;
- Hydrology;
- Noise; and
- Cultural Heritage.

Constraints and environmental sensitivities were first identified, and buffers applied in order to determine appropriate areas within the site to accommodate development. Consideration of the environmental sensitivities of the site included an analysis of the criteria listed above. This constraints exercise resulted in a developable area being defined. A comparison of environmental effects of following this design approach and not following it, i.e. applying mitigation by design versus a design which does not consider the various environmental factors of the receiving environment is presented in Table 2-4:

Table 2-4: Comparison of Potential Residual Environmental Effects - Mitigation by Design and Potential Impacts

Environmental Consideration	Mitigation by Design Utilised in the Annagh Wind Farm Project	Potential Impact if Mitigation by Design is not Included
Residential Amenity	The applicant set a minimum 700m set back from all non-financially involved inhabited dwellings, in line with the Wind Energy Development Guidelines. The closest involved landowner's dwelling is located 690m from the nearest proposed wind turbine.	Potential for impact to residential amenity due to noise, vibration and dust during the construction stage. Further potential impact to residential amenity during operations due to visual impact and noise if an appropriate setback distance is not applied.

Environmental Consideration	Mitigation by Design Utilised in the Annagh Wind Farm Project	Potential Impact if Mitigation by Design is not Included
Flora and Fauna	Avoidance of designated sites and mitigation designed to avoid potential impacts on species and habitats.	Potential for impact on designated sites hydrologically connected to the subject site. Potential for habitat loss and disruption due to impacts on water quality.
Ornithology	Avoidance of designated sites. Any hedgerow trimming or removal to be completed outside of the bird breeding season.	Potential impact to avifauna associated with the construction phase including possible deterioration of habitats and disturbance or displacement of birds.
Soils & Geology	Avoid infrastructure at steep gradients and at areas of unsuitable ground conditions.	Potential for landslide or subsidence if design does not consider gradient and ground conditions at proposed infrastructure locations.
Hydrology	Minimum 50m set back of infrastructure from rivers and streams where reasonably possible. Adaptation of design to existing hydrological regime (streams and drainage channels)	Potential impact to the existing hydrological regime if streams are diverted. Potential for runoff to directly discharge to streams.
Water Quality	Minimum 50m set back from significant rivers and streams and appropriate mitigation designed to avoid siltation during construction. Clear-span bridge and horizontal direction drilling to be used at stream crossings to avoid in-stream works.	Potential migration of silt or petrochemicals to watercourses. Potential impact on water quality and aquatic biodiversity. Potential impact on designated sites downstream.
Noise & Vibration	Ensure compliance with the relevant guideline limits for noise. A 700m setback between the turbines and non-financially involved dwellings has been achieved which will assist in maintaining residential amenity at local dwellings. Further mitigation measures have been set out in Chapter 7 – Noise and Vibration.	Potential for impact to residential amenity at nearby dwellings due to noise nuisance if appropriate setback between turbines and dwellings is not applied.
Shadow Flicker	Shadow flicker detection systems to be installed in turbines to avoid shadow flicker at nearby dwellings, in line with the Draft Revised Wind Energy Development Guidelines (2019).	Potential impact on residential amenity due to shadow flicker at nearby dwellings if control measures are not applied.
Cultural Heritage	Design takes cognisance of nearby recorded monuments and avoids them and their zone of influence where possible.	Potential impact on cultural heritage assets if infrastructure is placed in proximity.
Material Assets	Commercial forestry impacted by the proposed development will be replanted at an alternative site. No significant impact expected.	Commercial forestry impacted by the proposed development will be replanted at an alternative site. No significant impact expected.

Environmental Consideration	Mitigation by Design Utilised in the Annagh Wind Farm Project	Potential Impact if Mitigation by Design is not Included
Landscape & Visual	Buffering of residential receptors in order to maintain setback distance. Design consideration of sensitive visual receptors in the greater area.	Potential negative visual impact on sensitive visual receptors and potential impact on residential amenity if not considered in the design of the wind farm.

2.3.5 Alternative Scales and Design

Initially, following the establishment of the developable area of the Annagh Wind Farm Site, and as part of the design alternative process a number of different turbine heights were considered. The relationship between the turbine height and density (number of turbines) required to achieve a particular output was a key design consideration.

Several case studies and land surveys have highlighted that when given an option people tend to prefer a scenario of fewer larger turbines. One such study commissioned by Bord Fáilte (now Fáilte Ireland) in 2008 found that:

> "In terms of the size and composition of wind farms, tourists tended to prefer farms containing fewer turbines. If both produced the same amount of electricity, tourists also preferred wind farms containing a small group of large turbines (55%) to a large group of smaller turbines (18%)."

There is a balance to be struck between the visual and spatial dominance of turbines and the clutter and the frequency of turbines within a view as both of these effects contribute towards the magnitude of visual impact. This is illustrated in Figure 2-2, which compares a similar energy yield across three turbine heights within the same view. This is intended only as an illustrative diagram to show the balancing relationship between turbine height and density.

On the basis of these factors and through design stage analysis, consideration was given to the approach that the slightly increased sense of visual dominance imparted by taller turbines is preferable to the reduced level of permeability and increased visual clutter associated with a greater number of shorter turbines required to achieve the same output. Moreover, the perceived visual dominance of taller turbines is further offset by increased setback distances from residential receptors. In this regard, alternative turbine outputs were considered correlating to alternative turbine heights.

The consideration to provide fewer, larger turbines with greater power output is in line with industry trends. This option increases energy efficiency, improving the energy output to the national grid per turbine, thus reducing the cost of energy for the consumer. The use of less turbines also reduces the impact on the receiving environment with less land-take required to accommodate the wind farm and less associated construction works as detailed above. Recent permitted wind farm applications in Ireland tend towards larger/taller turbines (i.e.. the larger turbine tip heights that are available on the market in Ireland). Examples of recent consented wind farms which include larger/taller turbines are the Ardderroo Wind Farm, Co. Galway (ABP ref. PL07 .303086) which consists of 25 no. turbines at 178.5m tip height, the Coole Wind Farm, Co. Westmeath (ABP ref. PL25M.300686) which consists of 13 no. wind turbines of 175m tip height and Barnesmore Windfarm, Co Donegal (ABP ref. PL14 .306303) which consists of 13 turbines with tip height up to 180m.

This approach to design is examined further in the context of the alternative layouts considered for the Annagh Wind Farm in the following section.

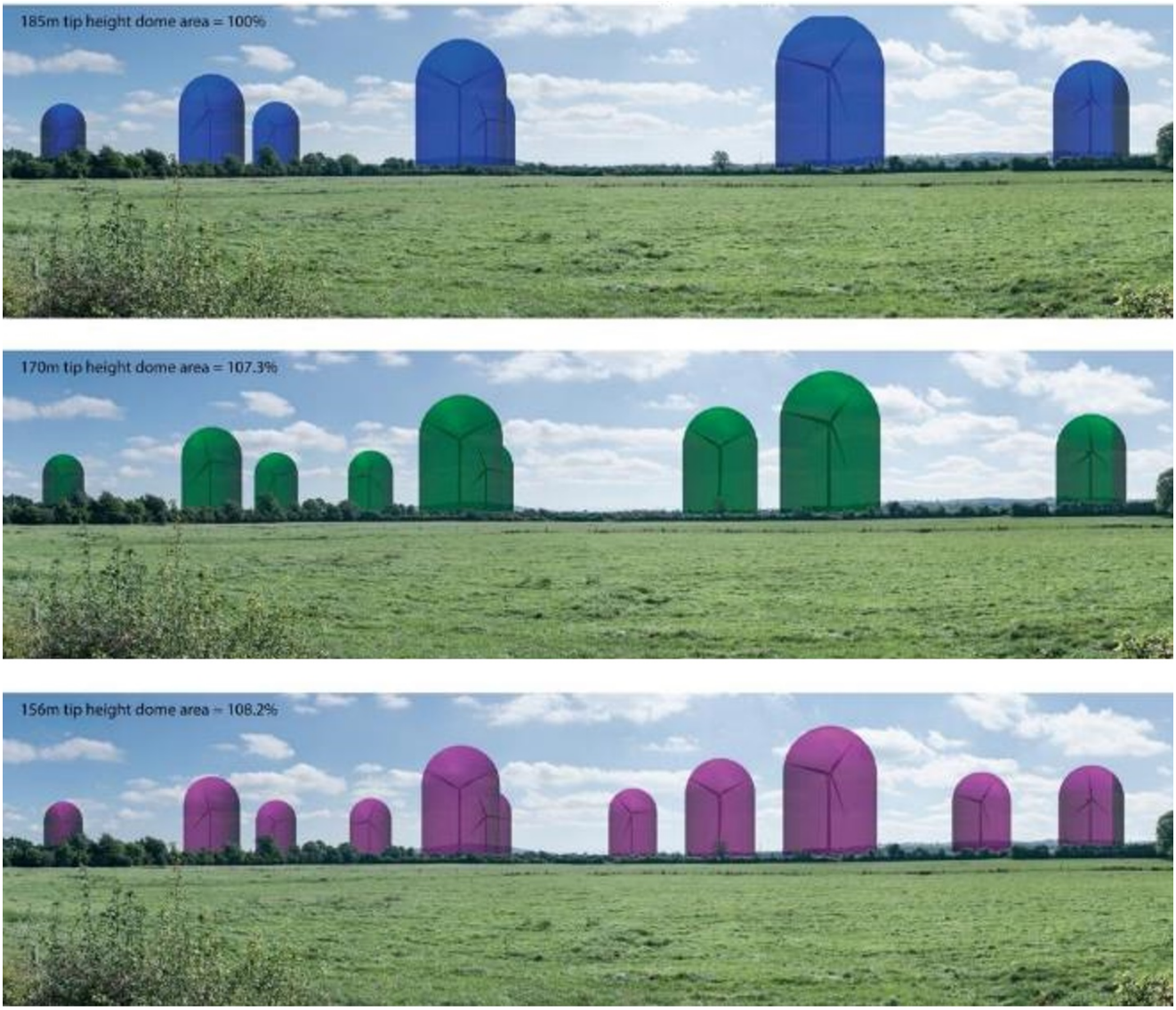

Figure 2-2: Turbine Height versus Density Relationship (Same Power Output for each Example)

2.3.5.1 Wind Farm Design Iterations

The design of the proposed Annagh Wind Farm was an iterative process which considered a range of alternative designs throughout the evolution of the project. The design iterations were influenced by potential environmental effects identified throughout the environmental assessment, leading to the evolution of the developable area of the project and the establishment of the final design as proposed. 5 no. design iterations were considered throughout the progression of the project. These are detailed in Table 2-5 and illustrated below.

Table 2-5: Alternative Wind Farm Design Options

Layout No.	No. of Wind Turbines	Tip Height	Rotor Diameter	Total Approx. Power Output
Initial Design	8	150	120	33.6 MW
Design Iteration 1	6	173	136	25.2 MW
Design Iteration 1b	6	185	150	37.2 MW
Design Iteration 2	6	175	150	37.2 MW
Design Iteration 3	6	175	150	37.2 MW

An initial design within the developable area of the wind farm site consisted of 8 no. wind turbines. This represented the maximum volume developable at the site and was considered with respect to environmental impacts. The turbine height considered for this initial layout was 150m tip height with 120m rotor diameter. This design achieved the desired megawatt (MW) output for the project at approximately 33.6MW. From the outset, this turbine layout was considered to have a higher significance of visual impact when viewed from a distance as the greater number of turbines located closer together created a sense of visual clutter. Furthermore, the inclusion of a turbine located approx. 200m from the boundary of the Blackwater River (Cork/Waterford) SAC was also considered to have greater potential for impacts on the European Site. The initial design iteration is illustrated in Figure 2-3.

An alternative layout was brought forward for Design Iteration 1 (DI1) which aimed to provide less turbines with a greater tip height and rotor diameter. The 6-turbine option reduced the loss of habitat by proving less hardstanding areas than the initial 8-turbine layout. However, this design included the use of turbines with a similar power output to the initial design iteration and following analysis, the overall expected power output of 25.2MW would not produce a significant amount of electricity for a viable project at the Annagh Wind Farm Site. DI1 is illustrated in Figure 2-4.

As a result, an alternative design was created for the project for Design Iteration 1b (DI1b). This design used similar turbine locations, however, with an alternative tip height and rotor diameter. DI1b utilised a 185m tip height and a 150m rotor diameter. This allowed for the 6-turbine wind farm to achieve a greater megawatt output of 37.2MW. This design was taken forward for environmental assessment. Initial assessment of DI1b revealed that T05 fell within proximity to an Archaeological monument, while it's access tracks passed through a recorded monument. Investigation of the T04 location revealed potentially unstable ground in the townland of Annagh Bogs. This turbine was also closely linked to the Blackwater River (Cork/Waterford) SAC where potential impact to the European site was identified. Furthermore, the proposed tip height of 185m was found to fall within 4x tip height distance from a number of nearby residential dwellings. Considering the provisions of the Draft Revised Wind Energy Guidelines, and the desire to reduce potential impact on residential amenity, as well as to reduce overall visual impact of the project, a redesign of the wind farm was considered necessary to reduce potential impacts and mitigate by design. DI1b is illustrated in Figure 2-5.

Design iteration 2 (DI2) reduced the tip height of the proposed turbines to 175m. This achieved a 4x tip height setback (700m) from all non-financially involved residential dwellings, with the closest financially involved dwelling located 690m from the nearest turbine. The reduction in height also slightly reduced the overall visual impact of the project. The design also reduced the amount of new access tracks throughout the wind farm site in an attempt to reduce the loss of habitat from hard surfaces. This also reduced the number of on-site watercourse bridge crossings from 4 no. crossings to 1. crossing.

T04 was moved further north to a position with better ground conditions, and infrastructure including access tracks, turbine hardstandings and turning heads were moved further away from the Blackwater River (Cork/Waterford) SAC to avoid potential impact on the European Site. The 6-turbine DI2 maintained the desired megawatt output of approximately 37.2MW. DI2 is illustrated in Figure 2-6.

Design Iteration 3 (DI3), referred to as the 'final design iteration', involved the production of a Civil Infrastructure Design which aimed to use the existing agricultural access tracks and utilise existing field boundaries and contours to achieve greater design harmony with the existing environment. The final design maintains a significant setback from the Blackwater River (Cork/Waterford) SAC with the closest point being approx. 270m from the SAC boundary where an existing agricultural track will be upgraded. The most proximate turbine hardstanding area is located at T04, approx. 650m north of the SAC boundary. The final design iteration allows for adequate setback from existing archaeological monuments in order to avoid potential impacts on cultural heritage assets. The design also utilises a clear-span bridge at the Oakfront Stream in order to avoid instream works and avoid potential impact on water quality. The final design iteration included the movement of the on-site substation from the south of the site to the west of the site. This was due to the location's susceptibility to flooding. This alternative substation location is further detailed in Section 2.3.5.4. The final design iteration (DI3) is illustrated in Figure 2-7.

The final design iteration layout maintains a 175m tip height and a 150m rotor diameter. Appropriate setback distances between turbine locations and nearby dwellings are achieved with a 4x tip height setback (700m) from all non-financially involved dwellings. The most proximate financially involved dwelling is located 690m from the nearest turbine (T03). Following shadow flicker analysis, as detailed in Chapter 12, a number of instances of shadow flicker were predicted for the final design iteration layout. Alternative technology was considered in order to reduce the potential occurrence of shadow flicker at nearby dwellings, in order to maintain residential amenity. This involves a proposed mitigation measure to install a shadow flicker control system to change a particular turbine's operating mode during certain conditions, or temporarily turn the turbine off if necessary. This system will eliminate the occurrences of shadow flicker at nearby dwellings. This is further detailed in Chapter 12: Shadow Flicker.

Following consultation with the developer of an adjacent permitted Solar Farm, T02 was relocated from its position at the northern boundary of the site to a location further south, in order to reduce shadowing effects on the adjacent permitted solar farm. As a result of this relocation, T05 was also relocated approx. 230m south west to reduce wind wake and optimise the layout. This removed the turbine from a forested area, reducing the felling requirement of the proposed development and reducing potential impact on habitats for bat species.

A comparison of potential environmental impacts of the wind farm site design iteration options and the final design iteration) for the proposed Annagh Wind Farm project is detailed in Table 2-6. The proposed option was developed to present the least potential environmental impact through the project philosophy of mitigation by design.

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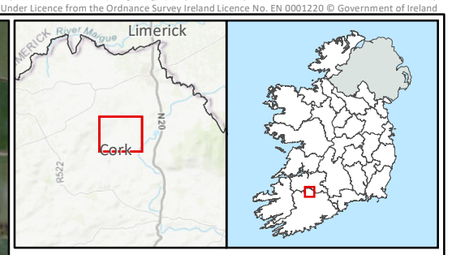

Legend

- Planning Boundary
- Turbine Layout

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TITLE:	Initial Design Iteration		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.3		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	02/09/2021	**PAGE SIZE:**	A3

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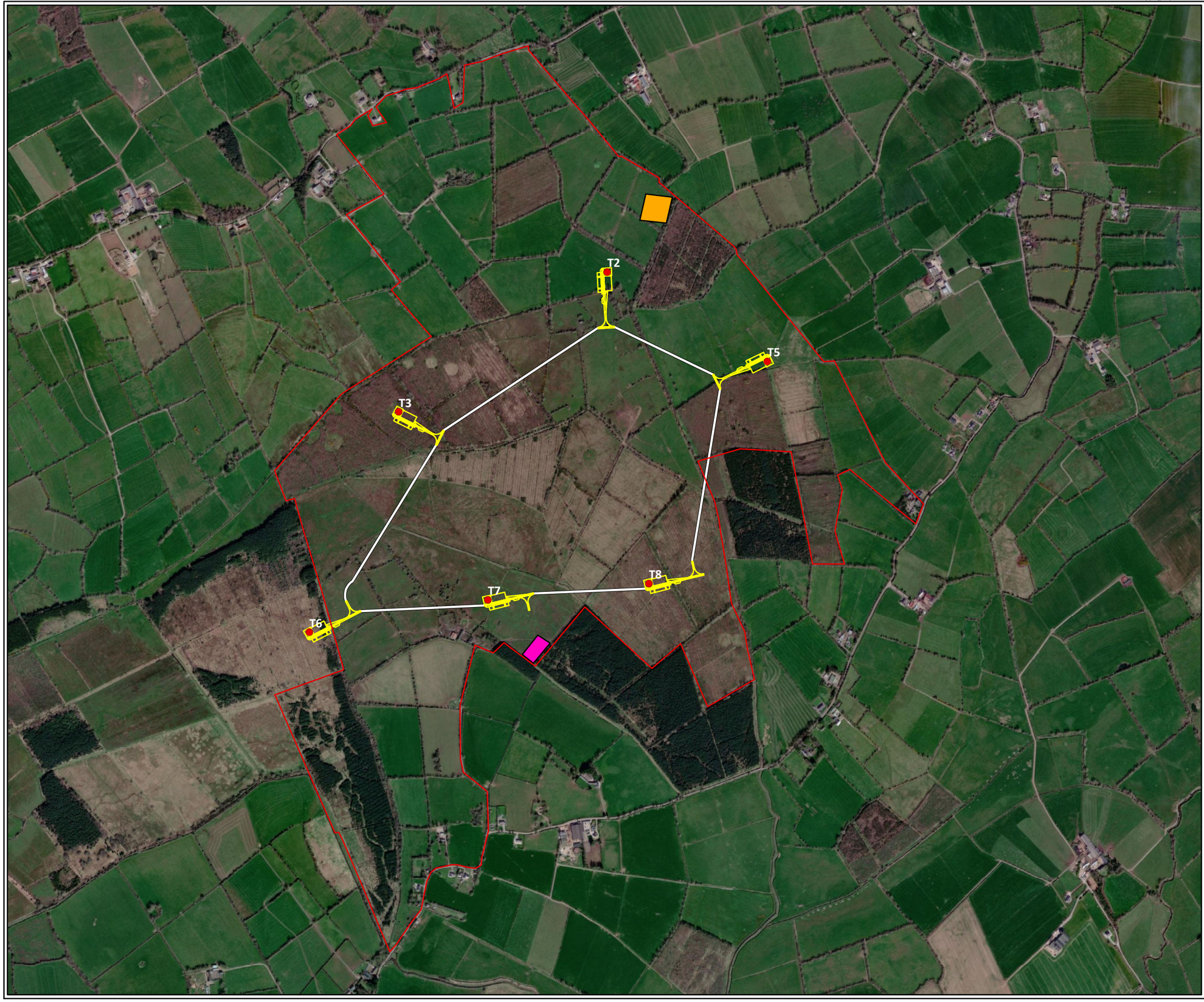

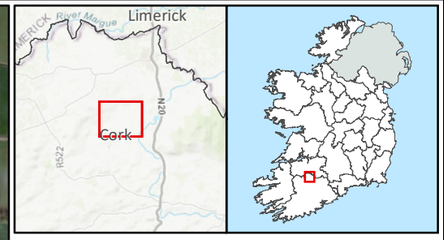

Legend

- Planning Boundary
- Turbine Layout
- Turbine Footprint
- Internal Access Track
- Construction Compound
- Substation

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TITLE:	Design Iteration 1		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.4		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	02/09/2021	**PAGE SIZE:**	A3

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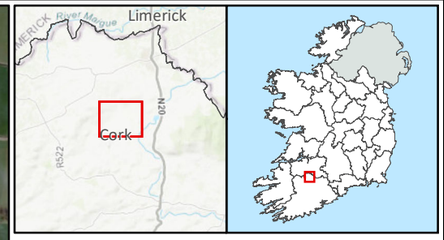

Legend

- Planning Boundary
- Turbine Layout
- Internal Access Track
- Turbine Footprint
- Construction Compound
- Substation

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TITLE:	Design Iteration 1b		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.5		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	02/09/2021	**PAGE SIZE:**	A3

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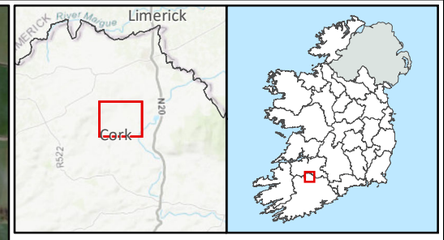

Legend

- Planning Boundary
- Turbine Layout
- Construction Access
- Internal Access Track
- Turbine Footprint
- Construction Compound
- Substation

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TITLE:	Design Iteration 2		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.6		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	02/09/2021	**PAGE SIZE:**	A3

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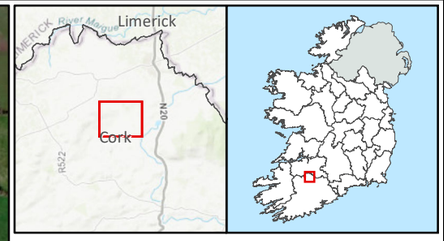

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Substation
- Construction Compound
- Turbine Hardstanding
- Turning Heads

Roads

- New
- Upgrade

TITLE:	Design Iteration 3		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	2.7		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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Table 2-6: Comparison of Potential Residual Environmental Effects of the Wind Farm Design Iterations

Environmental Consideration	Initial Design (8 Turbines, 150m tip)	DI1 (6 Turbines, 173m tip)	DI1b (6 Turbines, 185m tip)	DI2 (6 Turbines, 175m tip)	DI3 - Final Design Iteration (6 Turbines, 175m tip)
Air & Climate	Slightly greater impact during construction due to greater CO2 emissions due to greater number of turbines. Slightly greater potential for dust emissions due to larger area of excavation. Long-term positive impact on air quality due to production of clean renewable electricity.	Potential impact due to CO2 emissions associated with development on bogland. Slightly reduced long-term positive impacts on air quality and climate due to reduced power output for DI1.	Potential impact due to CO2 emissions associated with development on bogland. Long-term positive impact on air quality and climate due to production of clean renewable electricity.	Long-term positive impact on air quality due to production of clean renewable electricity.	Long-term positive impact on air quality due to production of clean renewable electricity.
Noise & Vibration	Potential for greater noise impact on nearby sensitive receptors due to greater number of turbines.	Design does not achieve 4x tip height setback in all instances, therefore, potential for greater noise impact at nearby dwellings.	Design does not achieve 4x tip height setback, therefore, potential for greater noise impact at nearby dwellings.	Design achieves appropriate setback distances. 4x tip height setback achieved. Slight to moderate significance of impact, with dwellings closest to the project.	Design achieves appropriate setback distances. 4x tip height setback achieved. Slight to moderate significance of impact, with dwellings closest to the project.
Biodiversity	Greater habitat loss due to greater area of hardstanding's. Greater potential for impact on nearby SAC due to closer proximity of turbines.	Greater potential for impact on nearby SAC due to closer proximity of turbines, located within 200m of the SAC boundary.	Greater potential for impact on nearby SAC due to closer proximity of turbines, located within 200m of the SAC boundary.	Slight to imperceptible negative impact on certain species and habitat. Potential moderate negative reversable local impact on bats.	Slight to imperceptible negative impact on certain species and habitat. Potential moderate negative reversable local impact on bats. Reduced impact on bats due to movement of 2 no. turbines outside of forested areas.

Environmental Consideration	Initial Design (8 Turbines, 150m tip)	DI1 (6 Turbines, 173m tip)	DI1b (6 Turbines, 185m tip)	DI2 (6 Turbines, 175m tip)	DI3 - Final Design Iteration (6 Turbines, 175m tip)
Ornithology	Greater potential of collision risk due to greater number of turbine blades.	Slight-Imperceptible reversible residual impact on birds.	Slight-Imperceptible reversible residual impact on birds.	Slight-Imperceptible reversible residual impact on birds.	Slight-Imperceptible reversible residual impact on birds.
Land, Soils, Geology	Larger area of excavation and soil disturbance required due to greater number of turbines.	Greater potential for soil instability on westernmost turbine located in an area of bog.	Greater potential for soil instability on westernmost turbine located in an area of bog.	Imperceptible residual impact following implementation of mitigation measures.	Imperceptible residual impact following implementation of mitigation measures.
Hydrology & Water Quality	T01 located within 50m of existing watercourse. Potential for impact on water quality at this point.	Greater potential of impact to water quality due to location of turbine in poorly drained bog area.	Greater potential of impact to water quality due to location of turbine in poorly drained bog area.	Potential for flooding identified at substation site.	Non-significant effects following mitigation.
Population & Human Health	Slightly greater potential for impact on residential amenity due to greater visual envelope and heightened noise as a result of the greater number of turbines.	Long-term imperceptible impact expected. Potential health and safety issues due to susceptibility of substation location to flooding.	Slightly greater potential for impact on residential amenity as 4x tip height setback to nearby dwellings not achieved. Potential health and safety issues due to susceptibility of substation location to flooding.	Long-term imperceptible impact expected. Potential health and safety issues due to susceptibility of substation location to flooding.	Long-term imperceptible impact expected.
Material Assets	Similar potential impacts following mitigation.	Similar potential impacts following mitigation. Potential shading impact on adjacent consented solar farm.	Similar potential impacts following mitigation. Potential shading impact on adjacent consented solar farm.	Similar potential impacts following mitigation. Potential shading impact on adjacent consented solar farm.	Reduced potential impact of shading on adjacent consented solar farm and reduced requirement of tree felling due to movement of T02 and T05.

Environmental Consideration	Initial Design (8 Turbines, 150m tip)	DI1 (6 Turbines, 173m tip)	DI1b (6 Turbines, 185m tip)	DI2 (6 Turbines, 175m tip)	DI3 - Final Design Iteration (6 Turbines, 175m tip)
Traffic & Transport	Slightly greater potential impact on traffic due to the greater quantities required to be transported to the site during construction.	Temporary slight impact due to construction activities.	Temporary slight impact due to construction activities.	Temporary slight impact due to construction activities.	Temporary slight impact due to construction activities.
Archaeology & Cultural Heritage	No expected impact to existing cultural heritage features.	Impact on 3 no. existing recorded monument due to location of T05 and access tracks passing through recorded monuments.	Impact on 2 no. existing recorded monuments due to location of T05 and associated access track.	No expected impact to existing cultural heritage features.	No expected impact to existing cultural heritage features.
Landscape & Visual	Greater potential visual impact associated with greater number of turbines.	Slightly less visual impact due to shorter tip height and smaller rotor diameter.	Greater potential visual impact associated with greater turbine height	Slight to moderate visual impact, subject to viewshed.	Slight to moderate visual impact, subject to viewshed.
Telecoms & Aviation	No expected impact.	No expected impact.	No expected impact.	No expected impact.	No expected impact.

The final design iteration was chosen to take forward for the proposed project as it strikes a balance between energy production capacity and avoidance of environmental sensitivities. The chosen option provides for the greatest amount of energy production while avoiding potential significant impacts on the receiving environment and achieving appropriate setback from dwellings and sensitive environmental receptors such as the nearby Blackwater River (Cork/Waterford) SAC. The reduction of the number of turbines from 8 to 6 reduced the potential visual impact and the decision to reduce the height of the turbines from 185m to 175m reduced the visual impact further while also achieving 4x tip height setback to non-financially involved landowner's dwellings.

2.3.5.2 Grid Connection

When considering an appropriate substation to connect the proposed Annagh Wind Farm to the national grid, substations in proximity to the site were identified and a feasibility study was carried out to identify which substation was the most appropriate from an environmental impact perspective. Five substations in proximity to the site were identified including the following:

- Milford 38kV Substation, located 9km north west of the wind farm site.
- Buttevant 38kV Substation, located 8km south east of the wind farm site.
- Newmarket 38kV Substation, located 20km south west of the wind farm site.
- Glenlara 110kV Substation, located 22km south west of the wind farm site.
- Charleville 110kV Substation located 3km north east of the wind farm site.

The feasibility study focused on environmental sensitivities and also considered the length of the cable route and the capacity at each substation. Considering ESB/EirGrids' Gate 3 Nodal Assignment rules which indicate that applications above 10MW will be assumed to connect to a 110kV node and new 38kV nodes (such as the proposed on-site substation) will be assumed to connect to a 110kV node, the 38kV substations in proximity to the site were discounted from the study as not being a reasonable alternatives. Therefore, the Glenlara and Charleville 110kV substations were taken forward for further consideration.

The Charleville 110kV substation was noted as the closest node to the site at 3.4km by road. Capacity was also identified at this substation. In relation to environmental sensitivities, routes from the proposed Wind Farm Site to the substation could be achieved without crossing national or European designated sites. Two watercourse crossings were identified and between 30 and 49 no. dwellings were identified along the route (dependent on the final route chosen). The short distance of the route, and its nature as a local road, was considered to have little impact on traffic and transportation. Considering these factors, this route was categorised as having low environmental sensitivity.

The Glenlara 110kV Substation is located at the town of Newmarket, approximately 28km by road from the proposed Wind Farm Site. Capacity was identified at this substation. In relation to environmental sensitivities, potential routes from the Wind Farm Site were found to cross the Blackwater River (Cork/Waterford) SAC at two separate points. Twelve watercourse crossings were identified and a significant amount of dwellings were observed along the route which passes through the town of Newmarket. Installation works on the 28km route, which includes local and regional roads, was considered to have a significant negative impact on traffic and transportation with an expected construction period of over 12 months. Considering these factors, this route was categorised as medium-high environmental sensitivity.

A comparison of potential environmental impacts of the two viable substation connection options is included in Table 2-7:

Table 2-7: Comparison of Environmental Effects of Potential Grid Connection Substations

Environmental Consideration	Glenlara 110kV Substation	Charleville 110kV Substation
Distance on Public Roads	Approx. 28km	Approx. 3.4km
Biodiversity	2 no. watercourse crossings at Blackwater River SAC	Avoids interaction with Natura 2000 network
Traffic & Transportation	Impact on local and regional roads over 12-month period.	Impact on local roads over a 3-month period during construction
Hydrology & Water Quality	Potential negative impact at 12 no. watercourse crossings during construction.	Potential impact at 2 no. watercourse crossings during construction.
Noise & Vibration	Significant temporary negative impact due to construction works on a significant number of residential receptors	Significant temporary negative impact on residential dwellings due to construction works

A comparison of potential environmental impacts of the substation nodes for the connection of the proposed wind farm to the national grid was considered. Due to its close proximity and comparatively less environmental sensitivities along the route, the Charleville 110kV Substation was selected as the preferred node for connection to the national gird. The potential alternative routes from the proposed on-site substation to the Charleville 110kV substation are discussed and compared in section 2.3.5.3.

2.3.5.3 Grid Connection

Following the selection of the substation node for connection to the national grid, alternative grid routes were considered from the proposed on-site substation to the Charleville 110kV substation. Three potential grid route options were considered and are illustrated in Figure 2-8. All options consist of an underground connection as this is the preferred method as set out in the Draft Revised Wind Energy Development Guidelines:

> "In general, it is considered that underground grid connections for wind energy projects are the most appropriate environmental and/or engineering solution, particularly in sensitive landscapes where the visual impacts need to be minimised. Therefore, this should be the default approach. However, there may be cases where specific ground conditions would prevent this, e.g. in upland locations where peat stability issues can arise form large-scale excavation."

Ground conditions along the local public roads were observed to be favourable for underground cables. Therefore, an option for an overhead line connection was not examined by the developer.

Grid connection Option A consists of approx. 6km of underground cabling including 3.4km in the public road running east along the L1322 local road from the proposed site entrance before turning north to meet the Charleville 110kV Substation along the L-5488-0 local road. The grid route crosses two existing underground electricity cables as identified from ESB network mapping and road inspection. This route includes 1no. stream crossing on the L1322 local road at the Rathnacally Stream and another stream crossing located within the wind farm site at the Oakfront Stream. These streams are hydrologically connected to the Blackwater River (Cork/Waterford) SAC. The route passes by 30 no. dwellings located along the public road and also passes through the zone of notification for a Recorded Monument (ref. CO007-049001- Vernacular House).

Option B consists of approx. 5.7km of underground cabling. This option has a similar alignment to Option A, exiting the wind farm site at the proposed site entrance and running along the L1322, however, Option B utilises a section of private lands measuring approx. 800m at the approach to the Charleville Substation. Here Option B enters the existing Rathnacally Wind Farm from the L1322 running north towards the wind farm before turning east, crossing the Rathnacally Stream and entering the Charleville Substation. The cable will be buried in the access track to the wind farm and then run along field boundaries towards the substation. This option avoids a bridge crossing on the public road and avoids the existing electricity cables identified in the L-5488-0 local road. Option B will require 2 no. stream crossing on private lands at the Rathnacally Stream and Oakfront stream, both of which are hydrologically connected to the Blackwater River (Cork/Waterford) SAC. This route option passes by 22 no. dwellings located along the public road and also passes through the zone of notification for a Recorded Monument (ref. CO007-049001- Vernacular House).

Option C consists of approx. 8km of underground cable. This route crosses agricultural fields through the wind farm site before exiting the site via the southern agricultural entrance onto an unnamed public road. This road travels east crossing the Oakfront Stream at an existing bridge structure. Route C then turns north where it meets the L1322 local road, where it follows the alignment of Option A, crossing the Rathnacally Stream at an existing bridge and turning north onto the L-5488-0 local road where it enters the Charleville Substation. Option C borders the Blackwater River (Cork/Waterford) SAC at the bridge crossing on the Oakfront Stream along the unnamed road to the south of the wind farm site. Furthermore, the route runs parallel to the SAC for approximately 600m at a distance between 50m and 100m. The route passes 49 dwellings, falls within the zone of notification of 3 no. recorded monuments including a Mound (CO007-073----), Castle – motte (CO007-156----) and Vernacular House (CO007-049001-) and passes in close proximity of two entries on the National Inventory of Architectural Heritage including Ballynoran House (ref. 20900713) and Cooliney House (ref. 20900712).

The 3 no. route options are illustrated in Figure 2-8 and a comparison of potential environmental effects of each route option is presented in Table 2-8:

Table 2-8: Comparison of Potential Environmental Effects of the Grid Route Options

Environmental Consideration	Grid Route Option A	Grid Route Option B	Grid Route Option C
Approx. Length	6km	5.7km	8km
Residential Amenity Including Noise and Air Quality	Route passes 30 no. dwellings with potential for heightened noise and impact from dust during construction due to close proximity to works.	Route passes 22 no. dwellings with potential for heightened noise and impact from dust during construction due to close proximity to works.	Route passes 49 no. dwellings with potential for heightened noise and impact from dust during construction due to close proximity to works.
Flora and Fauna	Two stream crossings which are hydrologically linked to nearby SAC.	Two stream crossings which are hydrologically linked to nearby SAC.	One stream crossing bordering SAC and one stream crossing hydrologically

Environmental Consideration	Grid Route Option A	Grid Route Option B	Grid Route Option C
			linked to the SAC. Route also runs parallel in proximity to the SAC. Greatest potential for impact on SAC.
Ornithology	No likely impact.	No likely impact.	No likely impact.
Soils & Geology	Route is contained within proposed tracks and the public road.	Off-road section of route running along agricultural field boundaries.	Off-road section of route crossing agricultural fields at the wind farm site.
Hydrology & Water Quality	2 stream crossings.	2 stream crossings.	2 stream crossings.
Cultural Heritage	Passes through zone of notification of one recorded monument.	Passes through zone of notification of one recorded monument.	Passes through zone of notification of three recorded monuments and passes in proximity of two entries on the National Inventory of Architectural Heritage. Highest potential for impact on existing cultural heritage assets.
Traffic & Transportation	Second shortest route on public road.	Shortest route on public road. Least amount of construction time on public roads.	Longest route on public road. Greatest potential for impact on the public road due to longer construction time.
Material Assets	Crosses two identified underground electricity cables.	Avoids identified underground services.	Crosses two identified underground electricity cables.
Landscape & Visual	No likely impact.	No likely impact.	No likely impact.

A comparison of potential environmental impacts is included in Table 2-7. From analysis of this table Option B has the least amount of potential environmental impacts, passing the least number of dwellings and having the shortest overall length within the public road, reducing potential traffic impacts associated with construction of the grid route. Option A has slightly greater potential environmental constraints due to proximity to a greater number of dwellings and lengthier construction activities within the public road.

Option C was found to have the greatest potential for environmental impact due to its closer proximity to the nearby SAC, proximity to a greater number of dwellings and proximity to a number of recorded monuments and listed buildings. It's overall greater length would also result in a longer construction period to take place on the public road. For these reasons Option C was discounted and Option B was selected as the optimal option. However, the final option selected for the proposed grid route was Option A, as the private lands on the approach to the substation could not be secured at the time of submission of the planning application and was therefore unviable. Therefore, the viable option with the least potential environmental impacts was chosen as the preferred alternative and taken forward as part of the proposed project.

ISO A1 594mm x 841mm

OVERALL SITE PLAN

Scale: - 1:10000

Project Management Initials: Designer: AF Checked: SK Approved: RG

tli GROUP

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PROJECT

Annagh Wind Farm
38kV Grid Connection

CLIENT

EMPower

CONSULTANTS

NOTES: -

Routes shown are indicative only at this stage and subject to further assessment.

Additional services and watercourses may be encountered on the route

LEGEND: -

- UGC Option A (5.97km) shown thus
- UGC Option B (5.72km) shown thus
- UGC Option C (8.00km) shown thus
- River/ Lakes shown thus
- SAC shown thus

ISSUE/REVISION

I/R	DATE	DESCRIPTION
F01	11.06.21	Issued For Information
F00	28.05.21	Issued For Information

PROJECT NUMBER

05-813

SHEET TITLE

Overall Site Plan

SHEET NUMBER

05813-DR-001

2.3.5.4 On-site Substation

When designing the on-site infrastructure for the proposed Annagh Wind Farm, it was considered important to find the optimal location for each element. A substation location was originally identified to the south of the site. This area is indicated in Figure 2-9 in relation to the final proposed layout.

The original substation position was selected due to its screened location in the corner of an agricultural field surrounded on two sides by existing forestry and not visible from nearby roads or dwellings. The location is also adjacent an existing agricultural track connecting to the public road to the south which was planned to be utilised to access the substation during operation. A desktop assessment did not identify any specific environmental constraints at the substation location.

However, during site investigation, the location was found to flood due to its topography and position adjacent significant drainage channels. Mitigation was initially considered to alleviate the flooding at this location, however, the potential change in hydrological flows at this location had potential to impact on the nearby SAC. Therefore, due to critical infrastructure being positioned in an area prone to flooding and potential for mitigation to impact on a nearby designated site, an alternative substation location was examined.

The proposed substation location, as indicated in Figure 2-9, was position in an area of existing forestry in order to screen the building and associated infrastructure from open views from the surrounding area. The location was confirmed to avoid flooding. Access is made from an existing agricultural track. Safety was also considered in the positioning of the substation with regard to potential catastrophic events. A 1.5x toppling distance setback (262.5m) was applied from each turbine location to the substation position to avoid impact on the proposed substation in the unlikely event that a turbine topples. The potential impacts of catastrophic events is further considered in Chapter 11 of this EIAR.

The alternative substation location is illustrated in Figure 2-9. A comparison of environmental effects of the substation options is included in Table 2-9. The chosen option, the 'proposed substation', is considered a safer option for both human safety and more robust in terms of potential environmental impacts.

Table 2-9: Comparison of Environmental Effects of the Alternative Substation Locations

Environmental Consideration	Proposed Substation	Initial Alternative Substation Location
Air & Climate	Imperceptible impact during construction.	Imperceptible impact during construction.
Noise & Vibration	Slight and temporary impact during construction. Potential to produce noise during operation, however, not located adjacent to sensitive receptors.	Slight and temporary impact during construction. Potential to produce noise during operation which may affect adjacent recreation tracks.
Biodiversity	Imperceptible impact.	Potential impact on SAC following flood alleviation mitigation.
Ornithology	Imperceptible impact.	Imperceptible impact.
Land, Soils, Geology	Imperceptible impact.	Imperceptible impact.
Hydrology & Water Quality	Imperceptible impact.	Potential change in drainage regime following mitigation.

Environmental Consideration	Proposed Substation	Initial Alternative Substation Location
Population & Human Health	Imperceptible impact.	Potential safety issues due to critical infrastructure located in an area susceptible to flooding.
Material Assets	Loss of small area of commercial forestry. To be replanted at alternative site.	Imperceptible impact.
Traffic & Transport	Imperceptible impact.	Imperceptible impact.
Archaeology & Cultural Heritage	No potential impacts envisaged.	No potential impacts envisaged.
Landscape & Visual	Imperceptible impact.	Imperceptible impact.
Telecoms & Aviation	No potential impact envisaged.	No potential impact envisaged.

Figure 2-9: Alternative On-site Substation Location

2.3.5.5 35-year Operational Life

Initially a 30-year operational life was considered for the proposed Annagh Wind Farm. This is largely in line with other permitted wind farm developments throughout the country. However, the lifespan of wind turbines allows for a 35-year operational life based on the emerging technological advancements in turbine manufacturing. Furthermore, it should be noted that section 7.2 of the Planning Guidelines 2006 states for the following:

> *'The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances'*

A 35-year operational period has also been considered when compared to a 30-year lifespan due to the long-term benefits to climate change and air quality.

As detailed in Chapter 6: Air & Climate, the proposed development will offset approximately 42,966 tonnes of CO2 emissions per annum. An additional 5-year operational period will therefore result in the offset of an approximate total of 214,830 tonnes of CO2.

A 35-year operational life will also have a positive impact on material assets by extending the offsetting of the use of fossil fuels for electricity production and increasing the amount of renewable electricity being supplied to the national grid, as required by EU and national renewable energy targets. This will also benefit Ireland's energy security for a longer period.

Potential negative impacts of a 35-year period of consent are consistent with a 30-year lifespan but extended in the short-term. These relate to residual short-term visual impact and short-term noise impacts on nearby residential receptors which are not considered significant. There are no impacts envisaged at the Grid Route (grid route and substation are to remain in place) or TDR during this period. It is therefore considered that a 35-year operational life will provide greater overall benefits, when compared to a 30-year operational life.

A comparison of the potential residual environmental impacts of the alternative project operational life considered is detailed in Table 2-10:

Table 2-10: Comparison of Potential Residual Environmental Impacts of Alternative Project Operation Life

Environmental Consideration	35-year Operation Life	30-year Operation Life
Air & Climate	Long-term positive impact on air quality and climate due to offset of CO2 emissions from fossil fuels. Additional 5-year offset to CO2 emissions.	Long-term positive impact on air quality and climate due to offset of CO2 emissions from fossil fuels.
Noise & Vibration	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise. Short-term additional period of slight to moderate impact on these receptors.	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise.
Biodiversity	Imperceptible and reversible impacts during operational phase. Slightly longer duration of imperceptible impact.	Imperceptible and reversible impacts during operational phase.

Environmental Consideration	35-year Operation Life	30-year Operation Life
Ornithology	Slight-imperceptible reversible impact on bird species during operational phase. Slightly longer duration of slight-imperceptible impact.	Slight-imperceptible reversible impact on bird species during operational phase.
Land, Soils, Geology	No residual impact envisaged.	No residual impact envisaged.
Hydrology & Water Quality	No residual impact envisaged.	No residual impact envisaged.
Population & Human Health	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise. Short-term additional period of noise at nearby dwellings.	Long-term slight to moderate impact on nearby dwellings as a result of the operational noise
Material Assets	Long-term positive impact by offsetting use of fossil fuel. Greater offset due to additional period of operational phase.	Long-term positive impact by offsetting use of fossil fuel.
Traffic & Transport	Imperceptible effect.	Imperceptible effect.
Archaeology & Cultural Heritage	No potential impacts envisaged.	No potential impacts envisaged.
Landscape & Visual	Slight to moderate visual impact, subject to viewshed as assessed in Chapter 15. Additional short-term visual impact as a result of extended operational life.	Slight to moderate visual impact, subject to viewshed as assessed in Chapter 15.
Telecoms & Aviation	No potential impact envisaged.	No potential impact envisaged.

2.4 Conclusion

This chapter of the EIAR has described the need for the development and the reasonable alternatives considered throughout the development process for the proposed Annagh Wind Farm. The need for the development is established in Section 2.2 and it centres on providing renewable electricity to the Irish national grid, in line with European and national policy objectives, and the need to meet EU Renewable Energy targets and national targets as set out in the Climate Action Plan (2019).

A description of the reasonable alternatives in terms of project design philosophies, technology, size and scale for the development of the Annagh Wind Farm project is detailed in Section 2.3. This section sets out the evolution of the proposed development and the alternatives considered. The section details the strategic site screening process i.e.. the high-level considerations in finding a suitable site for a renewable energy project. The assessment of the suitability of the candidate site then considers the proposed site in terms of policy and other environmental constraints. Alternative renewable energy technologies were considered and a comparison of potential environmental effects of the alternatives was provided.

The alternative layouts of the proposed development were established through the project philosophy of mitigation by design. Alternative density and scales were considered and the potential environmental impacts of various alternative turbine scales and numbers were compared. The alternative grid connection options were examined, and the optimal option was chosen as a result of environmental assessment.

Alternatives were also considered for other individual elements of the project including the proposed on-site substation and the proposed operational life of the project. These elements were arrived at through the avoidance of potential environmental impacts as detailed in the comparisons provided throughout section 2.3.

The final proposed layout of the Annagh Wind Farm as assessed throughout this EAIR is thought to be the optimal design which minimises impacts on the receiving environment, while providing significant renewable electricity to the national grid, in line with national energy and climate policy.

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 3 – DESCRIPTION OF THE PROPOSED DEVELOPMENT

Prepared for: EMPower

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3. DESCRIPTION OF THE DEVELOPMENT

3.1 Introduction

This chapter of the EIAR describes the existing site and the main components of the proposed project and provides details on the construction, operation and decommissioning of the proposed project in compliance with the EIA Directive.

A detailed summary of the proposed project assessed in the EIAR is contained in Section 3.5.1 and a description of the development for which consent is sought is contained in Section 3.5.2.

The proposed project assessed in this EIAR is comprised of the following key elements:

- The wind farm site **(referred to in this EIAR as** 'the Site');
- The grid connection route (**referred to in this EIAR** as the 'GCR');
- The turbine delivery route **(referred to in this EIAR as** the 'TDR').

The Site includes the wind turbines, internal access tracks, hard standings, permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm. Refer to Figure 3-2 for the general arrangement of the Site.

The Site includes lands in the townlands of Annagh North, Fiddane, Cooliney, Coolcaum.

The GCR passes through the townlands of Cooliney, Rathnacally, Farranshonikeen, Ardnageehy and Clashganniv.

The TDR passes through the townlands of Cooliney, Rathnacally, Farranshonikeen, Ardnageehy, Clashganniv and Ballyhay before it enters the national primary road network at the N20 between the townland of Ballyhay and the Port of Foynes, County Limerick.

Replanting lands have been identified in the townland of Emlagh, near Moyasta, County Clare. The replant lands have been assessed for cumulative impact throughout the EIAR.

An overview of the proposed project is shown in Figure 3-1. This illustrates the general layout of the proposed wind farm site, grid connection and turbine delivery route. The location of the proposed replant lands is identified in Figures 3-6.

3.2 Existing Environment

The proposed wind farm site is located in north County Cork, approximately 45km north of Cork City. The Site is located approximately 6km south west of Charleville and approximately 8km north west of Buttevant.

The Site is located in a rural area. The settlement pattern in the area is linear, made up of one-off rural housing and farmyards generally located along the local road network. The nearest settlement is the village of Churchtown which is located approximately 3km to the south of the Site.

Eircode data (2020) shows 104 no. dwellings located within 2km of the Site. This has been confirmed with a ground proofing survey and supplemented by a planning application search on the Cork County Council online planning register. This survey noted that houses are primarily placed in small clusters and linear settlement patterns. There are 73 no. residential receptors located within 10 no. rotor diameters (1.5km) of the proposed wind turbines and 31 no. residential receptors located within 1km of the proposed turbines. The closest residential receptor to a proposed turbine is located at a distance of 700m, apart from 1 no. financially involved landowner whose dwelling is located approx. 690m from the proposed turbine locations.

Access to the site is made from the L1322 local road which meets the N20 at Ballyhea, approximately 4km to the east of the proposed site entrance. HGV's shall approach the site via this route.

The Site is situated within a single sub-catchments as defined by the WFD, the Awbeg [Buttevant]_SC_010, as detailed in Chapter 10 – Hydrology and Water Quality. The GCR is also located within this sub-catchment.

The Site is situated within two sub-basins as defined by the WFD. These waterbodies are known as:

- Oakfront_010
- Awbeg (Buttevant) (West)_020

The main hydrology feature within the Site is the Oakfront Stream and the Fiddane 18/Ardglass 18 Stream. There is one hydrological feature associated with the GCR, the Rathnacally Stream. All surface runoff within the Oakfront_010, Awbeg (Buttevant) (West)_020 and Awbeg (Buttevant)_010 sub-basins drain to the Awbeg [Buttevant] [West], which forms part of the Blackwater River (Cork/Waterford) SAC. This river runs south east where it meets the River Blackwater, approximately 25km south east of the Site.

Further information on the existing hydrological environment for the project can be found in Chapter 10.

The Site encompasses a mixture of habitat types, with mixed broadleaved woodland (plantations), wet grassland and improved agricultural grassland, the main types of land cover present.

There are no European or nationally designated sites within the proposed Site. The Blackwater River (Cork/Waterford) SAC is located directly to the south west of the Site, approximately 190m from the proposed wind farm site at its closest point. The Ballyhoura Mountains SAC is located approximately 8km east of the Site and the Kilcolman Bog SPA is located approximately 9km south east of the Site. No other European Sites are located in proximity to the proposed Site. In relation to nationally designated sites, the Ballyhoura Mountains Proposed Natural Heritage Area (pNHA) and the Ballinvoneer Pond pNHA are located approximately 6.5km east of the Site.

Further information on existing habitats within which the project is located can be found in Chapter 8.

Land cover classification for the Site is presented in Figure 3-3. European sites within 15km of the Site are shown on Figure 8-5.

The wind farm site is generally flat with elevations ranging from approximately 105m to 95m above ordinance datum.

There are 19 recorded archaeological monuments located within 1km of the Site. These range in date from the Bronze Age (2400-500 BC) to the post-medieval period. There are no recorded monument types with potential visual alignment attributes located within 1km. There are no Protected Structures located within 1km of the Site. Further details on the existing environment in relation to archaeology and cultural heritage can be found in Chapter 14.

The majority of site underlain by Alluvium, small area underlain by Till derived from Namurian Sandstones and Shales. Reference to bedrock exposure at surface to the south of the site. Bedrock geology is made up of Copstown Limestone Formation (well bedded muddy limestone), the Hazelwood Limestone Formation (massive mud-grade limestone, possibly karstified) and the Liscarroll Limestone Formation (cherty, bioclastic limestone).

Landslide susceptibility is considered low due to the relatively flat topography. There are no recorded karst features on the site. The groundwater aquifer is considered locally Important in bedrock, only productive in local zones. Northern part of site is Regionally Important Aquifer – Karstified (diffuse). Groundwater vulnerability is considered medium (majority of site) to extreme at the south of the site.

The Site and GCR are located within the Fertile Plain and Moorland Ridge landscape character area (Cork County Development Plan, 2014). It is made up of low lying landscape, which comprises an extensive area of predominantly flat or gently undulating topography. The landscape is dominated by intensive mosaic farmland with patches of forestry throughout. The Site is made up of agricultural pastures and broadleaf forestry.

The GCR runs along the L1322 public road from the site entrance to the Charleville 110kV Substation in the townland of Rathnacally. The GCR follows the public road for approximately 3.4km. The GCR passes 30 no. dwellings along the route.

3.2.1 Wind Farms in the Surrounding Area

Figure 3-7 illustrates existing wind farms within 20km of the proposed site. The most proximate wind farms to the site are the Rathnacally Wind Farm, approx. 2km to the north east from the nearest proposed turbine, consisting of 2 no. turbines, and the Boolard Wind Farm, approx. 2.3km to the north west from the nearest proposed turbine, consisting of 2 no. turbines. These 4 no. turbines have a tip height of 150.5m and a rotor diameter of 101 meters.

Other nearby wind farms in the vicinity include the Knockatalig Wind Farm, approx. 8km east, Castlepook Wind Farm, approx. 9km east, and Kilberrihert Wind Farm, approx. 9km south west of the proposed Site.

3.3 Land Ownership

The lands associated with the proposed wind farm site are owned by a combination of private landowners. The GCR is primarily contained within the public road corridor with the exception of where the route leaves the on-site substation, traversing the wind farm site and where it enters the Charleville substation, where lands are owned by ESB.

3.4 On-Site Wind Resource

The layout of the proposed wind farm has been designed to minimise the potential environmental impacts of the wind farm, while at the same time maximising the energy yields of the wind resource passing over the site. Available wind speed is a key factor in determining the economic viability of potential wind energy locations. The 2013 Sustainable Energy Authority of Ireland (SEAI) Wind Speed Atlas identifies the site as having an average wind speed of between 7.4 and 7.5 m/s at 100 m above ground level.

3.5 Proposed Project

The proposed project will primarily consist of a wind farm of 6 no. wind turbine generators (WTG's), 1 no. permanent meteorological mast (PMM), and 1 no. substation compound along with ancillary civil and electrical infrastructure.

The total Maximum Export Capacity (MEC) of the wind farm is approximately 37.2 MW. The exact MEC will be dependent on the output power of the turbine model available at procurement stage.

The proposed turbine is the Vestas V150. This turbine has a rating of 6.2 MW. The proposed turbines will have the following specifications:

- Three bladed, horizontal axis type turbine;
- Height of 175m from the top of the foundation to blade tip height;
- Rotor diameter of 150m;
- Hub height of 100m.

The associated grid connection route (GCR) will consist entirely of underground 38kV cable and will connect the on-site substation to the existing Charleville 110kV Substation within the townland of Rathnacally. The GCR will be approx. 5.7km in length including 3.4km to be constructed primarily within the existing road corridor and 2.3km of underground cables to be installed within private lands within the wind farm site. The proposed GCR arrangement is illustrated in Figure 3-4. The GCR includes one stream crossing within the wind farm site and one stream crossing on the L1322 local road, as indicated in Figure 3-4.

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR). It is proposed that turbine deliveries shall approach the site from the North via Foynes Port, the N69, the N18, the M20, the N20 and L1322. Temporary accommodating works will be required at selected locations along the TDR to facilitate the delivery of large components to the site. These works are described in detail in Section 3.5.6.

The construction of the project in its entirety is expected to take between 12 - 18 months. Further details including a construction programme used as a basis of assessments in this EIAR is included in Section 3.6.

3.5.1 Summary of the Proposed Project Assessed in the EIAR

In summary the proposed project will consist of the following:

- Erection of 6 no. wind turbines with a blade tip height of 175m, rotor diameter of 150m and a hub height of 100m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure where necessary;
- Upgrade of existing entrance onto Local Road L1322;
- All associated drainage and sediment control including the installation of new watercourse or drain crossings and the re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. permanent onsite 38kV electrical substation to ESBN specifications including:
    - Control Building with welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting;
    - Security fencing;
    - All associated infrastructure, services and site works.
- Temporary accommodation works associated with the Turbine Delivery Route to facilitate the delivery of turbine components;
- 1 no. Temporary construction site compound and associated ancillary infrastructure including parking;
- Tree felling and associated replanting to facilitate construction and operation of the proposed development;
- Installation of underground medium voltage (20/33kV) and communication cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast with a height of 100m above ground level and associated access track;
- Installation of medium voltage (up to 38kV) underground cabling between the proposed on-site substation and the existing Charleville substation and associated ancillary works. The proposed grid connection cable works will include 2 no. watercourse crossings and the installation of 9 no. pre-cast joint bays;
- All associated site development works;
- A 10 year planning permission and 35 year operational life from the date of commissioning of the entire wind farm.

3.5.2 Summary of the Statutory Development Description for Consent

The proposed temporary accommodating works along the TDR to facilitate the delivery of large components to the site is considered as part of the project's assessment in this EIAR but does not form part of this application for consent. Equally, 1 no. pre-cast joint bay located at the entrance to the Charleville 110kV Substation to accommodate the grid connection is considered as part of the project's assessment but does not form part of this application for consent. A cumulative impact assessment has been carried out for replant lands at Emlagh, County Clare and is also not included in the application for consent.

Therefore, the proposed development description as per the statutory newspaper notice and the application form for which consent from Cork County Council is being sought is as follows:

- Construction of 6 no. wind turbines with a blade tip height of 175m, rotor diameter of 150m and a hub height of 100m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure where necessary;
- Upgrade of entrance onto Local Road L1322;
- All associated drainage and sediment control including the installation of new watercourse or drain crossings and the re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. permanent onsite 38kV electrical substation to ESBN specifications including:
    - Control building with welfare facilities;
    - Electrical infrastructure;
    - Parking;
    - Wastewater holding tank;
    - Rainwater harvesting;
    - Security fencing;
    - All associated infrastructure, services and site works.
- 1 no. temporary construction site compound and associated ancillary infrastructure including parking;
- Tree felling to facilitate construction and operation of the proposed development;
- Installation of medium voltage (20/33kV) and communication underground cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast with a height of 100m above ground level and associated access track;
- Installation of medium voltage (up to 38kV) underground cabling between the proposed on-site substation and the existing Charleville substation and associated ancillary works. The proposed grid connection cable works will include 2 no. watercourse crossings and the installation of 8 no. pre-cast joint bays;
- All associated site development works;
- A 10 year planning permission and 35 year operational life from the date of commissioning of the entire wind farm.

3.5.3 Turbine Layout

Figure 3-2 shows the proposed wind farm site layout. The layout of the proposed wind farm has been designed to minimise the potential environmental effects of the receiving environment while at the same time maximising the energy yield of the wind resource passing over the site. The layout reflects the outcome of the iterative design process. Further detail on the design philosophy, constraints and alternative layouts is detailed in Chapter 2 of the EIAR: Need for the Development and Alternatives Considered. Details of mitigation by design are included in Table 2-4 of Chapter 2 of the EIAR.

Turbine location co-ordinates in Irish Transverse Mercator (ITM) are detailed in Table 3-1:

Table 3-1: Proposed Turbine Coordinates

Turbine ID	ITM Coordinates	
	X	Y
T1	550828	617916
T2	550202	617693
T3	550973	617485
T4	549622	617242
T5	550128	617038
T6	550672	616895

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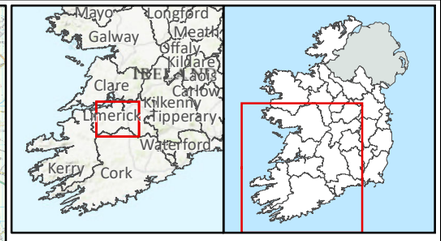

Legend

- Proposed Wind Farm Site
- Turbine Delivery Route
- Underground Cable Route

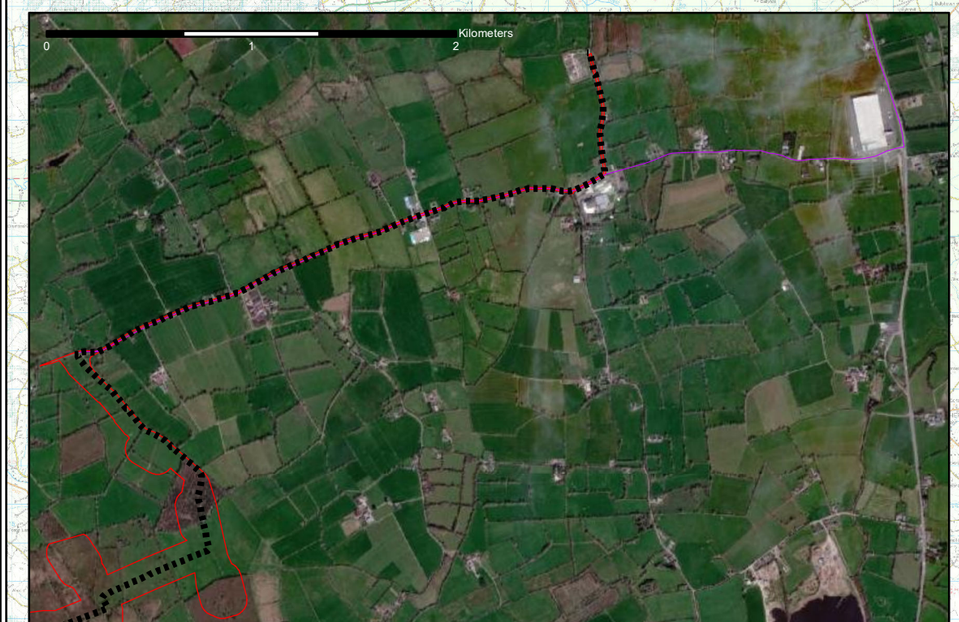

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FIGURE NO:	3.1		
CLIENT:	EMPower		
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DATE:	12/10/2021	**PAGE SIZE:**	A3

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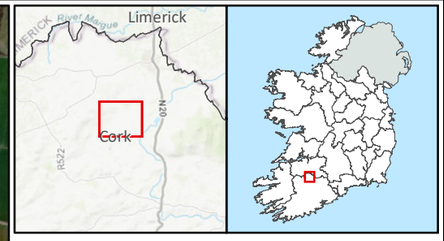

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Underground Cable Route
- Substation
- Construction Compound
- Turbine Hardstanding
- Turning Heads

Roads

- New
- Upgrade

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TITLE: Wind Farm Site Layout			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	3.2		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
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